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**Price Transmission in Food and Non-Food Product  
Markets: Evidence from Mexico**

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## Price Transmission in Food and Non-Food Product Markets: Evidence from Mexico\*

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**Abstract:** We document the existence of asymmetric price transmission in Mexico for a wide variety of food and non-food products, in terms of magnitude and speed, for two segments of the supply chain: i) Producer (producer-wholesale) and ii) Consumer (wholesale-retail). We find that asymmetric price transmission is a common behavior in many of the good markets that we studied. However, there are important differences across stages of the supply chain: in the Producer segment, the analyzed food products exhibit larger asymmetries compared to non-food products, while we observe the opposite in the Consumer segment. The existence of these asymmetries may have important welfare effects on poor households, since they allocate a higher proportion of their expenditure for the acquisition of goods that present positive price asymmetries.

**Keywords:** Price transmission, Positive price asymmetries, Food merchandises, Manufactured goods

**JEL Classification:** D43, L13, L11, C25

**Resumen:** Este trabajo documenta la existencia de transmisión asimétrica de precios en México para una amplia variedad de productos alimenticios y no alimenticios, en términos de magnitud y velocidad, en dos segmentos de la cadena productiva: i) Productor (productor-mayorista) y ii) Consumidor (mayorista-minorista). Encontramos que la transmisión asimétrica de precios es un comportamiento común en muchos de los mercados de bienes estudiados. No obstante, existen diferencias importantes entre etapas de la cadena de suministro: en el segmento Productor, los bienes alimenticios analizados muestran asimetrías más grandes respecto a los productos no alimenticios, mientras que observamos lo contrario en el segmento Consumidor. La existencia de estas asimetrías podría tener efectos importantes sobre el bienestar de los hogares más pobres, ya que éstos destinan una proporción mayor de su gasto al consumo de bienes que presentan asimetrías positivas de precios.

**Palabras Clave:** Transmisión de precios, Asimetrías positivas de precios, Mercancías alimenticias, Productos manufacturados

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## 1. Introduction

Many authors have researched price transmission dynamics in developed countries (see Peltzman, 2000; and Meyer & S. von Cramon-Taubadel, 2004 for a survey of the literature). A common finding in this literature is that most products exhibit positive asymmetric price transmission: consumer prices react more rapidly and with a greater magnitude with wholesale prices increases than with price decreases. The existence of asymmetric price transmission may have welfare implications: positive asymmetries yield, over time, higher consumer prices than if those asymmetries did not exist. Moreover, positive asymmetries can have different effects across income levels. For example, welfare effects on the poor may be higher if products with positive asymmetries represent a larger share in their food expenditure compared to high-income households.

The goal of this research consists on documenting the existence of asymmetries in price transmission in Mexico. To our knowledge, this is the first paper to assess the existence of this price behavior in a developing country for a broad number of consumer goods, and particularly for manufacturing goods. The analysis is performed at two stages of the supply chain: i) Producer segment (Producer-Wholesale) and ii) Consumer segment (Wholesale-Retail). We mainly use data from the Consumer Price Index (CPI) and the Producer Price Index (PPI).<sup>1</sup> Even though the aim was to include as many goods as possible, we had to exclude an important number of goods for different reasons. In total, for the Producer segment we analyzed 152 industries, which represent 31.7% of the PPI, while for the Producer-Consumer segment our universe consisted of 122 goods, which represent 28.6% of the CPI.<sup>2</sup>

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<sup>1</sup> The PPI reflects the first transaction of domestic produced items that represent around 80% of the national production. It comprises 567 items and excludes services, imports, distribution services (wholesalers, retailers), insurance and finance activities, as well as corporative, government and international organizations' activities. The CPI reflects prices paid by the average consumer for every one of the goods and services included in a representative basket that reflects the consumption of Mexican population. The Mexican CPI basket is comprised of 283 categories: 223 products (manufactured and non-manufactured) that represent 42.81% of the CPI, 46 services (43.06%), 5 energy goods (8.78%), and 9 price-control services (5.35%).

<sup>2</sup> We describe the reasons we dropped different items from the analysis in sections 2.1 and 2.2.

Many authors have put forward possible causes of asymmetric price transmission. Vavra and Goodwin (2005) classify them in four groups: i) sticky prices, ii) inventory management strategies, iii) government intervention, and iv) non-competitive markets. However, the most common hypothesis cited by the literature is non-competitive markets (Meyer and von Cramon-Taubadel, 2004) and it refers to the fact that in an oligopolistic market, firms tend to transmit swiftly increases in input prices to final prices as form to signal other participants that they want to maintain a collusive agreement. In contrast, when input prices fall, firms do not decrease their prices accordingly in order to avoid a price war.

Many national competition authorities (NCAs) from around the world have actively been using the existence of asymmetries in price transmission as a tool to identify markets with possible competition problems, especially in food and energy products. For example, in 2010 Lithuania's NCA used asymmetric price transmission in dairy products as a tool to identify markets with possible competition problems (OECD, 2013). Similarly, the Swedish NCA used asymmetries in price transmission as an indicator to detect possible markets with competition problems. In 2012, the UK's NCA (Office of Fair Trading) used asymmetries in price transmission as a tool to explore possible competition problems in petrol markets in 2012 (OFT, 2012).

In spite the fact that markets in developing countries are generally described as non-competitive and without robust competition legislation (Singh, 2014), few studies have attempted to estimate asymmetric price transmission for these countries. Most of these studies focus on the relationship between international commodity prices and domestic retail prices and, typically, only consider the Consumer segment. For example, Diaz *et al.* (2007) analyze price transmission dynamics of international prices to domestic powdered milk in Chile. They find that domestic powdered milk prices are highly influenced by international milk prices and that there is asymmetry in the speed of transmission, price increments reflect on consumer prices much faster than price decreases. Dutoit *et al.* (2010) analyze asymmetric price transmission in rice and corn markets across many Latin American countries and find that, in general, domestic prices are highly integrated with international prices and that asymmetric price transmission exists only in rice markets of Nicaragua and Brazil. Hosseini

and Moghaddasi (2011) study asymmetric price transmission along the supply chain in the fish market of Iran and documents the existence of positive asymmetries. Similarly, Alam *et al.* (2010) find evidence of positive asymmetric price transmission in the consumer rice market of Bangladesh.

The methodological approach used to estimate price transmission in the literature still broadly use the pre-cointegration methods first proposed by the pioneer work of Houck (1977) to identify and measure asymmetries in price transmission. However, some recent papers have proposed new techniques, such as cointegrations methods and Error Correction Models with Thresholds (ECMT) that incorporate nonlinearities into the analysis (Vavra and Goodwin, 2005).

In a seminal paper closely related to the work developed here, Peltzman (2000) uses the Distributed Lag (DL) model, originally proposed by Houck (1977), to analyze and quantify the asymmetric price transmission in 77 consumer and 165 producer items in three stages of the supply chain for the United States: (i) Producer-Wholesale, (ii) Wholesale-Retailer, (iii) retailer-final consumer. Peltzman (2000) found positive asymmetries for a large number of studied items. He also suggested that adjustment costs seem to be the main cause of these asymmetries. Similar to Peltzman's findings, we find large and persistent price asymmetries in the majority of the items we analyzed in the Mexican good markets.

Peltzman's methodology proved very useful to analyze an ample range of markets and it became well accepted in literature, promoting numerous papers to use and extend his methodology. For example, Archarya *et al.* (2011) and Deltas (2008) proposed modifications and extensions to Peltzman's methodology to study a broader set of issues, such as asymmetries originated from seasonality in the fruit, meat and gasoline markets. More recently, many papers have used threshold models to incorporate transactions costs as a leading factor of spatial market integration and non-linearities in the error correction process (Tong, 1983; Barrett, 1996; Fackler and Goodwin, 2001; and Stephens *et al.*, 2012). These models assume that transaction costs create a range in which input price variations do not trigger adjustments in output prices unless input price changes exceed a given threshold. In

practice, the estimation of threshold models requires large price time series with a balanced sample of price increases, price decreases and observations with no change.

Despite its importance in terms of consumer welfare, there are no studies of asymmetric price transmission across different stages of the supply chain in Mexico. To the best of our knowledge, most of the price dynamic studies focus on characterizing the price setting process at the consumer segment of the supply chain (Gagnon, 2009; Ysusi, 2010; Cortés, Murillo and Ramos-Francia, 2012; Kochen, 2015). Only Sidoui *et al.* (2009) focus on the pass-through between producer and consumer prices, but at an aggregate level and do not study the existence of asymmetric pass-through.<sup>3</sup>

In contrast to previous literature, to our knowledge, this is the first extensive analysis in price asymmetries for a developing country. Consistent with the results of Peltzman (2000) for the United States, positive asymmetries in price transmission for good markets is a wide spread behavior across the Mexican good markets we studied. Of the 152 industries analyzed in the Producer segment, 80 presented statistically significant positive price asymmetries (which represent 16.7% of the PPI). In the Consumer segment 77 of the 122 consumer goods (which represent 21.1% of the CPI) present positive and statistically significant asymmetries. Additionally, we find some differences between the estimated asymmetries of food and non-food products. In the producer segment, food products exhibit larger asymmetries than non-food products. In contrast, in the consumer segment, non-food products exhibit larger asymmetries than food products. We found that a sizable number of food products -such as meat, bread and beverages- present positive asymmetries.<sup>4</sup>

We also document that items with positive asymmetries represent nearly half of the food expenditure of the lowest income quintile in Mexico, which suggests that adverse welfare effects are more harmful for these households.

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<sup>3</sup> The authors analyze the causal relationship between the aggregated Producer Price Index (PPI) and the Consumer Price Index (CPI). They find that the information contained in the PPI can be useful to improve CPI forecasts.

<sup>4</sup> However, these conclusions do not extend to the goods not included in the analysis. Thus, a future study that analyzes price transmission for a bigger share of the CPI may reach different conclusions.

We organize the paper as follows. Section 2 describes the data sources and the construction of the time series used for the estimation of price transmission. Section 3 shows the empirical specification and the testing procedures used in the estimation of asymmetries. Section 4 describes the results of the estimations at an aggregated level and performs an in-depth analysis for food items. Finally, Section 5 concludes.

## 2. Data

We analyze price transmission in the Producer and Consumer segments using the Producer and Consumer Price Indices published by the National Institute of Statistics and Geography (INEGI, by its acronym in Spanish). The datasets comprise monthly price index series for 567 PPI items and 283 CPI goods. With these datasets, we construct numerous time series of input and output prices for two stages of the supply chain. For the Producer segment, we employ PPI data to analyze price transmission between input prices to wholesale prices of final goods. For the consumer segment, we use both the PPI and CPI data to examine price transmission from wholesale to consumer prices.

We used monthly price indices from January 1996 to December 2013. We chose this sample for two reasons. First, in early 1994, the government phased out price and trade controls on many agricultural products and staples such as corn, beans, wheat, tortilla and milk. In addition, the government gradually ruled out or reoriented supports for commercialization and liberalized trade. Second, we wanted to avoid possible biases in our results caused by the *Tequila crisis*, which had an important effect on the inflation of many domestic products. Nonetheless, we still perform time series tests on our data to determine their statistical properties.<sup>5</sup>

### 2.1 *The Producer Segment*

We analyze price transmission along the first stage of the supply chain of manufactured goods. It is also important to point out that the PPI data only reflect domestic prices; hence,

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<sup>5</sup> In particular, we performed unit root tests to all the series employed in this analysis. Among the tests we employed were Augmented Dickey-Fuller tests and the Elliot-Rothenberg-Stock. The series that showed changes in persistence or unit roots according to these tests were not included in the analysis.



we excluded all imported inputs and merchandise from our analysis. We exclude both raw products and services from the analysis and focus only on manufactured goods, since no information about production costs is available.

Our main source of information on costs is the 2009 *Economic Census*, which contains detailed information about production costs of manufactured products. While there is some data of production costs of raw materials and services in the census, the information on the main inputs of these kind of products (which are mainly labor, services and energy representing between 60 and 80% of the production costs on these goods) does not have enough detail. In contrast, on manufactured goods, in which raw materials and other manufactured goods represent over 60% of the production costs, the information is very detailed.

Figure 1 depicts this segment of the supply chain. The producer (manufacturer) transforms raw materials and other inputs into manufactured or consumption goods. We assume that the producer buys raw material at a wholesale price and sells their manufactured goods at a wholesale price as well. Thus, since we employ wholesale prices at both ends of this stage of the supply chain, we use monthly prices from the PPI to represent both raw materials bought by the producer and the manufactured goods produced and sold to retailers.

**Figure 1. Stages of the Supply Chains Analyzed in the  
Producer-Wholesale Segment**



The producer purchases inputs at wholesale prices, transforms them and sells the final product to a retailer.

In general, according to the 2009 *Economic Census*, producers use multiple raw and processed goods in the production of manufactured products. We construct input price series that combine prices of multiple raw and manufactured goods employed in the fabrication of the items included in the analysis. As weights for these input price indices, we use cost shares of raw materials and manufactured goods obtained from the Input-Output tables published in the 2009 *Economic Census* for 193 manufacturing national industries (6-digit North American Industrial Classification System, NAICS).<sup>6</sup> We excluded imported inputs since, as previously mentioned, PPI data only reflect prices of domestic products and the focus of this paper is price transmission between domestic prices.

On the other hand, since national industries often produce more than one good, we also build output price series combining all the manufactured goods produced by a national industry. However, in subsection 4.1.1, we present results at the item level for food products, since positive asymmetries in these markets may have important welfare implications.

We followed several steps to construct input and output price series at the national industry level. First, we selected those industries for which 50% of the input materials employed in the manufacturing process are of national origin.<sup>7</sup> Hence, we focused on 164 of 193 industries. Second, we employed Laspeyres indices to combine price series of the different inputs (or outputs) employed (or produced) by each national industry. As mentioned above, we used cost shares as weights for input price series. We included all inputs (raw materials and manufactured products) with cost shares higher than 5% in each industry. For output price series, we used the 2012 National Production shares published by INEGI as weights for output price series.<sup>8</sup> In total, we include in the analysis 423 PPI items inputs across the 164 national industries analyzed in this paper that represent 35.3 percent of the PPI.

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<sup>6</sup> According to the NAICS, in Mexico there are 1,049 national industries. The 2009 Economic Census reports Input-Output tables for 193 of the 1,049 universe of national industries.

<sup>7</sup> Since no data for import prices is available at the level of disaggregation we required, we exclude those industries in which the content of imported inputs is above 50 per cent of their total costs.

<sup>8</sup> This table reflects the share in the market value of all final and intermediate goods produced by all industries in Mexico (INEGI, 2013).

The price series presented some gaps of missing information, due to discontinued or recently introduced products. We filled these gaps using the variation of the next immediate industry aggregation level available (up to the three-digit NAICS series). We employed this procedure to complete missing data for 13 of the 567 PPI series.

As shown in section 3, the model employed to identify and quantify asymmetries in price transmission needs a reasonable amount of price decreases and increases in the sample. Thus, we excluded from the analysis those industries for which price increments or decrements on the input prices represent less than 5% of the sample. Fortunately, none of the industries included in the Producer segment fell in this category. We apply the same restriction to the series analyzed in the Wholesale-Consumer segment as well.

In table 1 we present an example of how we construct input and output series for two national industries: i) Industrial baking, and ii) Livestock, slaughtering and processing. For the case of Industrial baking, which produces Sliced bread and Packaged muffins and cakes, Sliced bread represents the lion's share of national production according to the National Production PPI weights published by INEGI (which are 0.12% and 0.03% for Sliced bread and Packaged muffins and cakes, respectively). Once we normalize the weights of both outputs, Sliced bread has a weight in the output price series of 82.5%. Similarly, according to the Economic Census, Wheat flour represents, by far, the main input by expenditure for this national industry (34.9%), with a normalized weight of 42.8%, since we excluded all items whose expenditure shares represent less than 5%. The input and output series of the Livestock, slaughtering and processing, national industry are constructed in a similar fashion.

Finally, since the method we use to estimate price transmission requires stationary time series, we performed Augmented Dickey-Fuller (ADF) unit-root tests for both input and output series and discarded those industries for which we could not reject the null hypothesis of a unit-root presence in either its input or output price.<sup>9</sup> Although some papers have shown

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<sup>9</sup> Additionally, we also performed tests with other unit root tests with more power, such as Elliot-Rothenberg-Stock (Generalized Dickey-Fuller, DFGLS), and tests by subsamples (using the 1996-2000 and the 2001-2013 periods) in order to check the change of persistence in the series. The results of the ADF test yielded similar outcomes.

that the headline inflation in Mexico do not have a unit root since the implementation of Inflation Targeting in 2001 (Chiquiar *et al.* 2010), the dynamics of aggregate price series do not necessarily reflect the behavior of individual price series. Thus, we performed unit root test for all price series employed in the analysis.

We decided to focus on stationary series for two reasons. First, there is no consensus on how to test asymmetric price transmission on non-stationary time series (see for example, von Cramon-Taubadel and Loy, 1999; von Cramon-Taubadel and Fahlbusch, 1994; Capps and Sherwell, 2007; Frost and Bowden, 1999; and Borenstein *et al.*, 1997). Second, some authors argue that usual characteristics of price series (such as structural changes) could generate important biases in the tests for asymmetries in price transmission (see Gauthier & Zapata, 2001).

Table 2 shows the 164 national industries included in the analysis and the reasons of their exclusion. We grouped these national industries in 20 categories: 10 manufactured non-food subsectors (corresponding to three-digit NAICS) and 10 processed food industry groups (corresponding to four-digit NAICS). In total, we excluded 12 industries from the analysis: Rice milling and wheat milling because the input and output price series were the same, 10 industry classes (from five different subsectors of economic activity) because we could not reject the unit root hypothesis for their price series.

The final set included 152 activity classes (116 non-food and 36 food) that represent around 31.7% of the PPI. Many of the non-food products are concentrated in one industry group (Primary and Fabricated Metal and Nonmetallic Mineral Product Manufacturing with 30 of the 152 national industries analyzed in this paper); while food products are concentrated in three main industry groups: (i) Grain and seed milling, fats and oils, (ii) Beverage and tobacco manufacturing, and (iii) Other food manufacturing.

Table 3 shows the behavior of input and output prices for the national industries analyzed in this paper. There are common patterns in both groups, in terms of dynamics of input and wholesale price series. Input prices (wholesale) present more frequent price increases (fluctuating between 54% and 72% of the observations) than price decrements (ranging

between 28% and 46% of the observations), while the percentage of months in which the index does not change with respect to the previous month is low (fluctuating between 0% and 10% of the observations). In average, each input price series is a composite Laspeyres index of eight PPI items; this is the main reason behind the low percentage of months in which we observe no change in these price series.

Wholesale (retail) prices have more recurrent price increments (between 38% and 78% of the sample) than decrements (between 5% and 34%). However, no-change observations of wholesale prices (between 0% and 48% of the sample) are significantly higher than for input prices. This also may be due to the fact that, in contrast to input prices, output prices, are on average composed of only two PPI items.

## *2.2 The Consumer Segment*

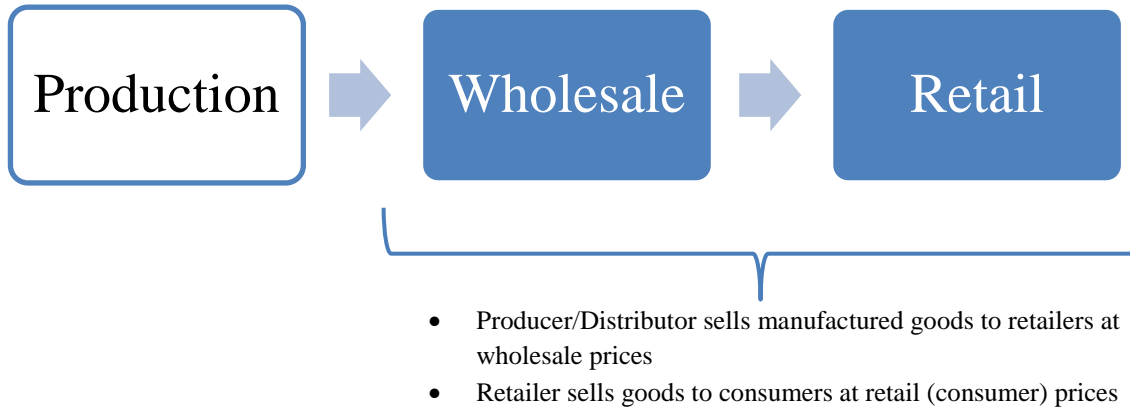
In this section, we analyze price transmission dynamics between the wholesale and the retail segments of the supply chain. Figure 2 illustrates this segment of the supply chain. First, the retailer purchases the final good at a wholesale price, and then sells the same item to a consumer at a retail (consumer) price. For this analysis, we use price series from the PPI and CPI to represent wholesale and consumer prices, respectively. We perform the analysis at the item (product) level, which are the analogous of the Entry Level Items of the United States CPI. From the universe of 283 items in the Mexican CPI, we exclude all services and government controlled goods.<sup>10</sup> The reason for their exclusion is that the quotes used to calculate the PPI and CPI are the same, which implies a total correspondence PPI-CPI. The quotes of these products only differ by the tax when applicable because the producer of these goods usually also commercializes them.<sup>11</sup>

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<sup>10</sup> Altogether, 60 of the 283 CPI items correspond to services, energy and government tariffs. Their weight in the CPI, measured by their expenditure share, is 57%.

<sup>11</sup> In particular, since services PPI and CPI prices use the same quotes, we can expect (and indeed observe) that price transmission is one for positive and negative price changes, which implies an asymmetry of zero. This conclusion is, of course, inaccurate since there is no real “wholesale” price.

**Figure 2. Stages of the Supply Chains Analyzed in the Wholesale-Consumer Segment**



Given that there is no transformation of goods in this stage of the supply chain, ideally we should compare the wholesale price of one item with the retail price of exactly the same product. Since in many cases CPI items represent two or more items of the PPI, we combine many items of the PPI in order to get wholesale price series comparable to the consumer price series employed as retail prices. Thus, we match each CPI item to one or more PPI items to obtain its wholesale price. When a CPI item is matched with more than one PPI good, we calculated a Laspeyres index to create the wholesale price. We used the share of PPI items in private consumption reported in the 2012 Private Consumption Tables published by the INEGI as weights for the construction of the wholesale price series. We excluded those goods for which the information employed to calculate the PPI and CPI is the same in both indexes (i.e. the same price quotes are employed in both indexes).<sup>12</sup> However, not all CPI items could be matched to a PPI item, since many of them did not have an exact match. We had to exclude 53 items from the CPI that did not have an exact match in the PPI.

An example of the construction of wholesale prices is given in Table 4 for two items, Other fruits and Fresh milk and pasteurized milk. In both cases, two or more PPI items were

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<sup>12</sup> These items are White bread, Sweetbread and Corn tortillas. In these cases, the PPI and CPI price quotes only differ by the value added tax.

employed in the construction of these wholesale price series. In the case of Fresh milk and Pasteurized milk, we used Pasteurized milk and Unpasteurized milk PPI items, where the first one represents 1.15% of the PPI weight in total private consumption. Once we normalize the weight, it represents 82.4% of Fresh milk and Pasteurized milk. A similar process was followed for Other fruits, where Mango has a larger share. To fill gaps in the series, we followed the same methodology employed in the Producer segment. We used the variation of the next available level of aggregation to impute it as the variation of the product with missing values.<sup>13</sup>

As in the Producer-Wholesale segment, we used PPI items to represent wholesale prices and, thus, we have some input prices with small price variation, especially in contrast with CPI prices, which on average have 74.2 establishments as a source of price quotes.<sup>14</sup> Accordingly, we excluded from the analysis items in which price increments or decrements in input prices represented less than 5%, for the same reasons described in the Producer segment. In the Consumer segment. Since we matched many goods with only one PPI item, this problem is more prevalent than in the Producer segment. Finally, we also performed unit-root tests for wholesale and consumer prices.

Table 5 summarizes all the goods left out from the analysis in the consumer segment. For the sake of the analysis, price series are grouped in 18 expenditure categories: 8 manufactured non-food merchandises and 10 processed and raw food items. From the original universe of 223 goods, we left out of the analysis 53 items because they did not have a corresponding item in the PPI, 3 because PPI price series of these items were the same as their corresponding CPI price series, and 19 more due to insufficient price variation. Finally, we excluded 26 items because we could not reject the unit root hypothesis. Overall, after eliminating items with low variation or unit roots, we ended up with 122 series. The 70 food items stand for 15

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<sup>13</sup> Thus, for example, in the case of “Disposable tissues”, with missing values from January to December 1996, we used the expenditure group “Toilet paper and disposable tissues”. When an item showed missing values for more than three years we dropped it from the analysis.

<sup>14</sup> The CPI collects price quotes from 21,000 establishments for 283 items in the index. Thus, on average every item of the CPI collects price quotes from 74.2 establishments. In contrast, PPI items have only 11.3 establishments per item as a source for information, INEGI (2013b).

percent of the CPI, while the 52 non-food manufactured products represent 13.6 percent of the CPI.

Table 6 shows some statistics of price dynamics in this segment. In general, for both wholesale and retail, as well as across expenditure categories, price increases are more common than decreases. In addition, retailer price indices change more frequently than wholesale prices, except for raw food products, where wholesale prices indices present frequent variations. Compared to the statistics reported in Table 3, the difference between the output and the input frequency of price increases is larger in this segment of the supply chain. Finally, non-food retail prices show more frequent price increments than food items.

### 3. Empirical Analysis

We estimated the following Error Correction Model (Hendry and Richard, 1983; Hendry *et al.*, 1984):

$$\Delta P_{it} = \beta \Delta P_{it-1} + \sum_{k=0}^K \delta_k \Delta I_{it-k} + \sum_{k=0}^K \gamma_k D_{it-k}^+ \Delta I_{it-k} + \alpha (\Delta P_{it-1} - \Delta I_{it-1}) + \sum_{n=0}^N \varphi_n \mathbf{Z}_{it-n} + u_{it} \quad (1)$$

where  $\Delta P_{it}$  and  $\Delta I_{it}$  are the first difference of the logarithm of the output price and input price of good/industry  $i$ , respectively,  $D_{it}^+$  is a dummy variable that takes the value of 1 whenever  $\Delta I_{it} > 0$  and zero otherwise; an autoregressive term ( $\Delta P_{it-1}$ ) was included to control for persistence in price changes. The  $\mathbf{Z}_{it}$  vector corresponds to different control variables, detailed below. In addition, the error correction term ( $P_{it-1} - I_{it-1}$ ) was included to control for the long-term relationship between output and input prices.<sup>15</sup> The estimation is performed for each good in the case of the consumer segment and each industry in the case of the Producer segment.

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<sup>15</sup> For the cases where we found no statistically significant evidence of a long-term relationship between input and output prices, we estimated an Autoregressive Distributed Lag model (ADL), with the same specification. This model is also frequently used when testing for asymmetric price transmission (Boetel and Liu, 2008; Zachmann and von Hirschhausen, 2007).



The number of lags ( $K$ ) for the input price changes was selected using the Akaike Information Criterion (AIC).<sup>16</sup> Given the great variance in the frequency of price changes between the items included in our sample (section 3), we used three general specifications with different lag length in which we classified every input-output pair according to the optimal lag selection of the AIC: (i) a three-lag model, (ii) a nine-lag specification and (iii) a fifteen-lag model.

One common issue in the estimation of asymmetric price transmission is collinearity between the regressors that capture positive and negative price changes. In our data, this problem originates from the low number of observations with price decreases. Collinearity may create inference problems (e.g. high standard errors and problems in the stability of estimated parameters) and may promote an over-rejection of the symmetry hypothesis (Gauthier and Zapata, 2001). To deal with this issue, as mentioned above, we dropped all the items in which price decreases represent less than 5% of the sample.<sup>17</sup>

The control variables included in the Consumer segment are different from the ones employed in the Producer segment. In the Producer segment, we include the change in the Domestic Industrial Production Index published by INEGI, the US ISM Manufacturing Composite Diffusion Index (as published by the Federal Reserve Bank of St. Louis). Finally, we also add the percentage change in hourly earnings and oil prices.<sup>18</sup>

On the other hand, for the Consumer segment, we used changes in the Index of Domestic Private Consumption of Goods published by INEGI, and the US CPI less food and energy (published by the Bureau of Labor Statistics). As in the Producer segment, we included the

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<sup>16</sup> The purpose of using the AIC as the criterion was that this statistic tends to select a larger lag structure, which yield results that are more robust for both, unit root tests and standard errors (Maddala & Kim, 1999).

<sup>17</sup> Since in our specification uses total, positive and negative variations of input prices, as long as the number of price decreases is large enough, there should be limited collinearity between these two regressors. Furthermore, as pointed by Ravallion (1986), collinearity is not enough reason to adopt a more restrictive specification because this may create imposed restrictions on the model or employ methods that may cause loss of information (e.g. Principal components), which could produce omitted variable bias. Likewise, the removal of variables can affect the precision of coefficients.

<sup>18</sup> We expressed both of these variables in nominal terms and in the local currency (Mexican pesos).

percentage change in hourly earnings and oil prices.<sup>19</sup> Likewise, we used changes in the Mexican peso and the US dollar exchange rate to control for variations in the exchange rate in both segments of the supply chain.

For all control variables we started with an initial specification of 5 lags per variable. However, there were not significant gains in the Akaike information criteria (AIC) and, in most cases, lags beyond the contemporaneous variable were non-significant at the 10% confidence level, except for the exchange rate, which resulted significant up to three lags for a broad set of items. Given the reduction of degrees of freedom from including many lags, we decided to use only the contemporaneous effect for all control variables, except for the exchange rate, which included three lags in our final specification.<sup>20</sup> Finally, since Mexico transited to an inflation-targeting regime in 2001, we included a dummy variable that takes a value of one after 2001, to control for this regime shift in both Producer and Consumer segments.

### 3.1 *Estimation of Asymmetric Price Transmission*

From the model presented in equation (1) we are interested in estimating the cumulative output price response of an input price change. The cumulative output price response is of interest because it measures the total effect of an input price change on the output price. The positive pass-through after  $k$  months is given by the cumulative output price changes between period  $t$  and period  $t + k$  that results from an input price *increase* of 1 percent is given by:

$$\sum_{j=0}^k \frac{\partial \Delta P_{t+j}}{\partial I_t | D_t^+ = 1} \quad (2)$$

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<sup>19</sup> For both segments of the supply chain, other variables we also tested as controls. For the Producer-Wholesale segment, we tested the Average Daily Wage in the Manufacturing Sector and an Index of Energy prices as controls for supply shifts and the Global Index of Economic Activity (IGAE, by its acronym in Spanish) and the G7 Industrial Production Index. In the Wholesale-Retail segment, we used the IGAE and the G7 CPI as controls for demand shifts. However, our main results did not substantially change with other control variables.

<sup>20</sup> Details about these tests and estimations using other control variables are not reported here but are available upon request to the authors.

Similarly, the negative pass-through after  $k$  months is the cumulative response to an input price *decrease* of 1 percent:

$$\sum_{j=0}^k \frac{\partial \Delta P_{t+j}}{\partial I_t \mid D_t^+ = 0} \quad (3)$$

The asymmetric price transmission after  $k$  months is given as the difference between the cumulative transmission of input price increases and input price decreases:

$$\sum_{j=0}^k \frac{\partial \Delta P_{t+j}}{\partial I_t \mid D_t^+ = 1} - \sum_{j=0}^k \frac{\partial \Delta P_{t+j}}{\partial I_t \mid D_t^+ = 0} \quad (4)$$

From our specification, we analytically derive the cumulative price pass-through (positive and negative) and the cumulative asymmetry and then we estimate them as non-linear functions of the model parameters. For example, the positive pass-through after  $k$  months is the sum of the coefficients  $(\delta_i + \gamma_i)$  each multiplied by different terms formed by the autoregressive and error correction coefficients  $\beta$  and  $\alpha$ . Similarly, the negative cumulative pass-through is equal to the sum of coefficient  $\delta_i$  multiplied by the same terms as in the positive pass-through. Hence, the cumulative asymmetry after  $k$  months is the sum of coefficients  $\gamma_i$  each 1 multiplied by these terms formed by the coefficients  $\beta$  and  $\alpha$ .<sup>21</sup>

## 4. Results

### 4.1. Producer-Wholesale Segment in the Supply Chain

Table 7 summarizes the estimations of asymmetric pass-through for 152 industries grouped in 20 categories according to the economic subsector (three-digit and four-digit of the NAICS).<sup>22</sup>

The coefficients are interpreted as the difference, in percentage points, between the output price change after  $t$  months derived from a 1% input price increase with respect to the output

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<sup>21</sup> Another possible strategy is to estimate the price pass-through and price asymmetries using impulse-response functions of an input price increase and decrease. This strategy is convenient when there are several autoregressive terms as in Peltzman (2000). Our estimations using this strategy and the method described here yield the same results.

<sup>22</sup> For the sake of the analysis, we only report the estimated asymmetries in price transmission; however, positive and negative pass-through estimations are available upon request.

price change resulted from a 1% input price decrease. We found significant and persistent positive asymmetries across a wide spectrum of goods. In contrast, negative asymmetries were scarce and non-significant across most groups. In terms of importance, industries in the non-food sector that exhibit positive asymmetries represent around 10.6% of domestic production; while in the food sector they represent 6.1% of all production.

On average, positive asymmetries tend to be higher in the food sector than in the non-food sector. About 51% of the national industries in the manufactured food sector show positive asymmetries up to the sixth month mark. In contrast, only 49.2% percent of the non-food industries included presented positive price asymmetries. The most relevant groups in the food sector in terms of the magnitude of their positive asymmetries after 6 months are: (i) Animal slaughtering and processing (1%); (ii) Sugar and confectionery product manufacturing (0.65%), and (iii) Grain and seed milling and fats and oils (0.6%). In the non-food sector, the groups with higher positive asymmetries are: (i) Chemical manufacturing, (ii) Machinery manufacturing and (iii) Primary metal and non-metallic mineral manufacturing, all of them with an asymmetry of around 0.4%. The asymmetries in food and non-food sectors reach their largest magnitude in the fourth month and decrease afterwards.<sup>23</sup>

Table 8 shows price transmission in terms of speed. We calculated the speed of price transmission relative to the 6 months accumulated pass-through. Notice that, for some goods, the peak of the accumulated pass-through is reached earlier (numbers are greater than one). This is because the accumulated positive or negative pass-through in earlier months is greater in absolute terms to the accumulated pass-through at the 6-month mark. According to the speed results, the food sector, once again, shows larger asymmetries in the speed of price

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<sup>23</sup> Positive pass-through is with the expected sign and highly significant in all of the analyzed groups, except for Fruits, vegetables, stews and Prepared meals freezing in which positive price transmission was not significant, although the coefficient had the expected sign. The magnitude of the pass-through was mainly around 0.5 percent and in just in one case was 0.2. In contrast, negative pass-through was significant only for 10 of the 20 groups analyzed. However, it has the expected sign in all but three cases. The magnitude of the negative pass-through was rarely above 0.5, and in most cases, it was below 0.3. Results are available upon request.

adjustments in this segment of the supply chain: input price increments transmit quicker to final prices than input price decreases.

#### *4.1.1. Results by Item for Food Products in the Producer-Wholesale Segment*

Compared to the non-food sector, the food sector presents more pervasive and persistent asymmetries in the Producer segment; hence, we conduct a more detailed analysis of these products. In order to do this, first we match each industrial activity to a specific item belonging to the PPI. We disaggregated the 35 food industry classes for which we conducted the analysis at the Producer-Wholesale segment by their producer price indexes that conform them. To represent the output price of a given PPI product, we reweight the items belonging to the industry class to give 20% more weight to that specific product.<sup>24</sup> Since we do not have input information at the product-level, we keep the same input price series at the national industry-level.

For illustrative purposes, Table 9 shows some of the main results of this analysis. We report the highest accumulated asymmetries after three months when we found at least one of them was statistically significant and positive (marked by dark grey if the result corresponds only for the Producer segment and a diagonal pattern if we used this result also in the Consumer segment for the discussion in section 4.3). If none of those asymmetries were positive and statistically significant, we report the accumulated asymmetry after three months (not shaded). Asymmetries are mostly concentrated in products belonging to three categories: Cereals and related products; Livestock, slaughtering and processing, and Beverages. In these categories, practically all of the products included here present a certain degree of positive asymmetry in price transmission at some point. For example, in the Grain and seed milling and fats and oils manufacturing category, only Corn flour does not show positive asymmetry. Likewise, Beef carcasses, Pork carcasses, Poultry carcasses, Beef meat and Poultry meat do not present positive asymmetries in the Livestock, slaughtering and processing category. In

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<sup>24</sup> For example, the activity class “Livestock, slaughtering and processing” is comprised of 3 producer prices: Beef meat, Swine meat and Poultry (Table 3). The original weights used to construct the output price of the industry class, derived from the 2012 National Production Weights of INEGI, are 0.06 Beef meat, 0.05 Swine and 0.88 Poultry. To get the output price for beef, we use the following weights: 0.26 for Beef meat, 0.04 for Swine and 0.69 for Poultry.

the Beverage industry, all non-alcoholic beverages exhibit significant and persistent positive asymmetries. In contrast, most items in the Fruit and vegetable preserving and Dairy products manufacturing industry classes show no statistically significant positive asymmetries.

Some of the most important products in the food consumption basket of Mexican households such as bread, soft drinks, meats, powder milk and instant coffee present positive and statistically significant asymmetries. As shown in section 4.3, positive asymmetries in these items may have important welfare effects on households the bottom income quintile.

#### *4.2. Wholesale-Retailer Segment in Supply Chain*

Table 10 summarizes the estimated asymmetries for 122 items (goods) analyzed in the Wholesale-Retail segment grouped in 18 expenditure categories (8 non-food and 10 food). As in the Producer-Wholesale segment, we also found significant evidence of persistent positive asymmetries across many items in the sample; in fact, even more than in the Producer-Wholesale segment. Negative asymmetries are non-significant in most cases, and when they are, they are only significant for one period. The weight on the CPI of non-food products that report positive asymmetries is 10.8%, while for the food sector their share represent 10.3% of the CPI.

Likewise, in the case in the Producer segment, we observe different patterns between food and non-food sectors for the Consumer segment. Positive asymmetries in the food sector are smaller than in the non-food sector, mainly driven by the relatively low asymmetries in Fresh fruits and Fresh vegetables. However, food group categories such as Other foods (1.5% at the 6-month mark); Sugar, coffee and soft drinks (close to 1%) and Bakery products (0.8%) show some of the largest positive asymmetries.

The highest and most significant asymmetries in the non-food sector were (i) Housekeeping supplies (0.85%); (ii) Footwear and accessories (0.8%); and (iii) Personal care supplies (0.78%). Note also that the magnitude of these asymmetries increases over time and is more

persistent than in the Producer segment; in the non-food sector positive asymmetries reach their maximum value at 6 months, whereas in the food sector they reach it at 5 months.<sup>25</sup>

Table 11 shows the speed of positive and negative price transmission. In the non-food sector, asymmetries tend to increase homogeneously across groups and at a relatively constant speed. For many of them, asymmetries tend to keep growing or stay at a constant level. On the other hand, processed and raw food products show quite heterogeneous speed patterns and, in many cases, asymmetries tend to fade over time. Relative to the findings reported for the Producer segment, in the Consumer segment we observe smaller asymmetries in the speed of transmission between positive and negative price shocks.

#### *4.2.1. Results by Item for Food Products in the Wholesale-Retailer Segment*

In this section, we report the disaggregated estimates used to construct aggregate results reported in Table 10. For illustrative purposes, in table 12 we only show asymmetries that were positive and statistically significant after 1, 2 or 3 months (marked by dark grey). When there was no positive and statistically significant asymmetries, we report the three-month estimated asymmetry in pass-through and leave the item unshaded. Once again, we focus on the food sector due to the importance its weight in the CPI and since many of their products are included in the consumption basket of low-income households.<sup>26</sup> In total, 32 items exhibit positive and statistically significant asymmetries in at least one period, which represent more than 40% of the analyzed items. Asymmetries in those items are also, in general, persistent: they are positive and statistically significant for more than one period.

Fresh fruits and vegetables present the lowest (positive) asymmetry levels, with the notable exception of Lemons, Beans and Grapes. In contrast, Sugar, coffee and soft drinks present persistent and high levels of positive asymmetries. Meats and animal products, such as Beef

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<sup>25</sup> Positive asymmetries were always significant and with the expected sign on both, food and non-food items. The magnitude was between 0.3 and 0.8 points. The negative pass-through was highly significant and with the expected sign for almost all food groups; however, in three cases it was not significant and in one case was significant but with the wrong sign. For non-food items, the negative pass-through is never significant but for three cases and in two of them it has the wrong sign. The coefficient of this pass-through never has a magnitude bigger than 0.5. Results are available upon request.

<sup>26</sup> Households in the bottom income quintile spend 33.2% of their total expenses on food products.

meat, Pork and Poultry also present significant and positive asymmetries, which together represent almost 4% of the CPI. Other animal products such as Fish and Other seafood, however, do not present positive asymmetries.

Moreover, there are nine items analyzed in the Producer segment with positive asymmetries in which the PPI and CPI prices were the same or that had no match in the PPI (marked with a diagonal pattern in Table 9). If we include the asymmetries estimated for those products, then 41 food items presented positive asymmetries: 32 from the Consumer segment (marked in dark gray in Table 12) and 9 from the Producer segment (marked with a diagonal pattern in Table 9). Together, these products represent 11.7% of the Mexican CPI.

#### *4.3. A Brief Discussion of the Importance of Price Asymmetries*

In the long-run, positive asymmetries may generate higher price levels. When this price behavior is present in food markets the main consumption items of the poorest households, they can have important negative welfare effects. The main cause of this is that poor Mexican households have a hard time substituting food products. As shown in Juárez (2015), population in lower income quintiles show a less diversified diet. The consumption of cereals, vegetables and poultry provide more than 60% of their required daily calorie intake. Moreover, population in the bottom income quintile have higher price nutrient elasticities for cereals and vegetables than those in the top income quintiles. This implies that price increments translate in drastic reductions in nutrient intake (Juárez, 2015).

This goes hand in hand with the low price elasticities of demand estimated in food products for low-income Mexican households in comparison to higher income households.<sup>27</sup> Thus, price increments in this kind of products translate in daily reductions in food consumption, aggravating under nutrition conditions, with long-term effects in their productivity and poverty.

Figure 3 illustrates the markedly regressive effects of positive price asymmetries, especially in food items. Urban bottom quintile households spend on average nearly 20% of their total

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<sup>27</sup> See Attanasio *et al.* (2013) and Juárez (2015).



expenditure on goods that present positive price asymmetries. In contrast, households in the top income quintile allocate less than 10% of their expenditure in this kind of items.

Food expenditure is the main driver behind this pattern: while the bottom income quintile spends 16% of their total expenditure on food products with positive asymmetries, households in the top income quintile only allocate 5.3%, which represents less than a third of their expenditure on food products. For non-food items, the expenditure on merchandises with positive price asymmetries is similar across income quintiles, and even slightly progressive. However, non-food products with positive asymmetries are goods of daily consumption in Mexican households, like toothpaste, detergent, etc.

It is important to mention that we were not able to study an important number of products, so welfare effects may be higher than what we propose here. For future research, given the relevance of positive price asymmetries for welfare, it is important to investigate their origin. Following the economic literature, the study of market imperfections, such as poor competition and adjustment costs, could provide some guidelines to reduce these asymmetries and improve welfare, especially for the poorest sectors of population. In particular, the implementation of a more effective competition policy and the implementation of policies that reduce adjustment costs (i.e. improvement in the coordination between market participants, better infrastructure, etc.) may help to reduce these asymmetries.

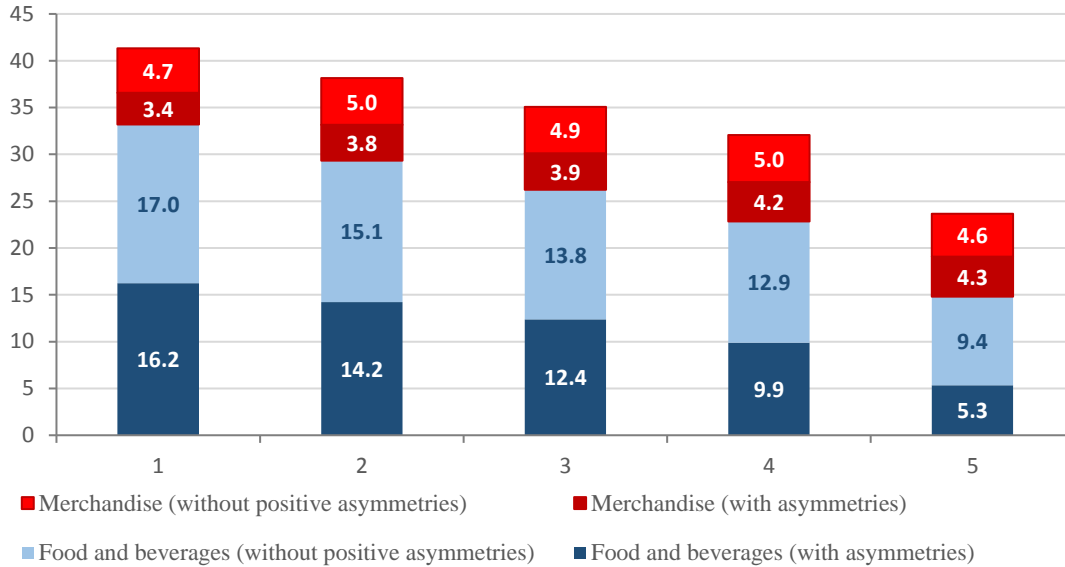
In line with this, the elimination of positive price asymmetries can have considerable effects in poverty. In an exercise published in the Bank of Mexico's *Quarterly Report April-June 2015* the complete elimination of positive price asymmetries in the 41 food products mentioned in section 4.2.1 had an estimated effect of a 11 per cent reduction in food poverty (1.7 million people).<sup>28</sup>

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<sup>28</sup> In this exercise, we assumed that the positive price asymmetries we found in 41 products were eliminated for the period January 2006-August 2014, which corresponds to the month when CONEVAL carried out the last measurement of poverty in Mexico. Afterwards, price levels were simulated assuming that positive price asymmetries were zero. This implied a reduction in the cost of CONEVAL's basic consumption basket of 5.1% with respect of the observed cost in August 2014 and 1.7 million less people in food poverty in urban areas in contrast with the 15.8 million calculated by CONEVAL. Further details are provide in Banxico (2015).

**Figure 3. Share of Urban Households' Expenditure for the Analyzed CPI Products<sup>1/</sup>**

(Percentage of household's total expenditure, average 2006-2014)



<sup>1/</sup> Estimation of the expenditure share of items with positive asymmetries could be higher since other products excluded from the analysis could also show such price dynamics. In this sense, the referred estimation represents a lower bound of the quantification of the effect.

Source: Own estimations using data from ENIGH 2006, 2008, 2010, 2012 and 2014. Expenditure shares of goods with positive asymmetries correspond to 41 food and 26 non-food merchandise found with positive and statistically significant asymmetries in the Consumer-Retail segment.

## 5. Conclusions

This study provides empirical evidence of the existence of asymmetries in price transmission in Mexican markets. We perform a general characterization of asymmetries in price transmission in terms of its magnitude and speed for a wide range of industries and markets across two stages of the supply chain: Producer and Consumer segments.

The analysis presented in this article shows that for the Producer segment 80 of the 152 studied national industries exhibit positive asymmetries in price transmission, which represents 16.7% of domestic production (10.6% in the non-food sector and 6.1% in the food sector). In this segment of the supply chain, positive asymmetries tend to be higher in magnitude and speed for food industries than for non-food industries. Industrial groups like Livestock, slaughtering and processing; Sugar and confectionery product manufacturing; Grain and oilseed milling; Chemical manufacturing; Machinery manufacturing and Primary metal and non-metallic show the highest magnitudes.

For the Consumer segment, 77 of the 122 analyzed good markets exhibit positive asymmetries in price transmission, which represents 21.1% of the CPI (10.8% in non-food products and 10.3% in food products). In this segment, the non-food products tend to present the greatest asymmetries with homogenous and constant speed across groups like Housekeeping supplies, Footwear and accessories, and Personal care supplies. In the food products groups, Fresh fruits and Fresh vegetables drive the low-asymmetry outcome. Other products such as Sugar and coffee, Soft drinks, Beef, Pork and Poultry exhibit significant and positive asymmetries.

Of special interest for the analysis are the markets with persistent positive asymmetries in both segments of the supply chain such as Sugar, coffee and soft drinks, and Bakery products and tortilla manufacturing.

In terms of their weight in the Mexican CPI, the empirical evidence of this study suggests that positive asymmetries in price transmission is a common practice across the analyzed good markets. Hence, the presence of high and persistent positive asymmetries may

contribute to both higher levels of inflation and poverty. However, we could not analyze a significant number of items, so we cannot generalize our results to the whole of the CPI. This remains an important subject of future research.

From a policy perspective, the reduction and eventual elimination of such asymmetries may have a significant impact on the welfare of poor households. Mostly because the consumption of low-income households is highly concentrated on food products characterized by positive asymmetries.

Finally, a future research agenda in this area should include the study of factors originating price asymmetries, including those previously identified in the economic literature: adjustment costs (asymmetries in inventory management, menu costs, etc.) and competition problems. In particular, if lack of competition were a leading factor in the generation of positive asymmetries in price transmission, the identification of positive price asymmetries would be of special interest from a policy perspective of developing countries.

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**Table 1. Examples of Weights Employed in the Construction of  
Input and Output Price Series in the Producer-Wholesale Segment**

<i>National industry (6-digit NAICS)</i>	<i>PPI item</i>	<i>Weight in the national production PPI index (%)<sup>1/</sup></i>	<i>Normalized weight employed in the construction of output price series (%)</i>	<i>Share in the total expenditures in raw materials per industry (%)<sup>2/</sup></i>	<i>Normalized weight employed in the construction of input price series (%)</i>		
<i>Livestock, slaughtering and processing</i>	<b>Output</b>	Beef carcasses	0.03	18.56	—	—	
		Pork carcasses	0.02	13.73	—	—	
		Poultry carcasses	0.12	67.71	—	—	
	<b>Input</b>	Beef cattle	—	—	9.46	9.65	
		Swine	—	—	8.31	8.48	
		Poultry	—	—	80.28	81.87	
	<b>Total</b>	<b>0.17</b>	<b>100.00</b>	<b>98.06</b>	<b>100.00</b>		
	<i>Industrial baking</i>	<b>Output</b>	Packaged muffins and cakes	0.03	17.54	—	—
			Sliced bread	0.12	82.46	—	—
<b>Input</b>		Egg	—	—	5.72	7.02	
		Wheat flour	—	—	34.92	42.83	
		Vegetable oils and fat	—	—	16.82	20.63	
		Sugar	—	—	9.82	12.05	
		Powder milk	—	—	7.63	9.36	
Other organic chemicals		—	—	6.62	8.12		
<b>Total</b>		<b>0.15</b>	<b>100.00</b>	<b>81.52</b>	<b>100.00</b>		

**Source:** Own estimations.

**Notes:** 1/ Weights reported by INEGI for the construction of the PPI, National production price Index. These weights represent the approximate participation of each PPI item in the gross value of total national. 2/ Share in the total raw material expenditure reported by each national industry in the 2009 *Economic Census*.

**Table 2. Analyzed Industries at the Producer-Wholesale Segment, (six-digit NAICS)**

Raw food and processed food products			
Subsector (3-digits NAICS)	Industry class (6-digit NAICS)	PPI Items	Weight in the PPI (%)
<b>1 Grain and seed milling, and fats and oils manufacturing</b>			<b>2.066</b>
1	Corn flour manufacturing	148 Cornmeal	1.373
2	Edible vegetable fats and oil manufacturing	156 Edible vegetable oils, 157 Shortening, 158 Margarine	0.232
3	Rice milling	138 Wheat flour	0.207
4	Breakfast cereals manufacturing	173 Cornflakes	0.096
5	Starch and other starch products manufacturing	176 Starches	0.094
6	Flour milling	172 Rice	0.035
7	Malt manufacturing	187 Malta	0.029
<b>2 Livestock, poultry and other edible animals slaughtering and packaging</b>			<b>1.905</b>
8	Livestock, poultry and other edible animals meat cutting and packaging	100 Beef meat, 101 Poultry, 102 Pork meat	1.436
9	Livestock, poultry and other edible animals meat sausages and other preserves preparation	103 Ham, 104 Sausages, 105 Smoked, dried and spiced meat, 106 Bacon, 107 Chorizo, 108 Meatloaf 109 Other cold meats	0.263
10	Livestock, poultry and other edible animals slaughtering	093 Beef carcasses, 094 Pig carcasses, 095 Poultry carcasses	0.171
11	Lard and other edible animal fats manufacturing	096 Lard, 097 Pork Skin, 098 Entrails, 099 Other animal carcasses	0.035
<b>3 Beverage and tobacco industry</b>			<b>1.870</b>
12	Soft drinks and other nonalcoholic beverages manufacturing	189 Bottled soft drinks	1.005
13	Brew manufacturing	188 Beer	0.494
14	Cigarette manufacturing	192 Cigarettes	0.105
15	Water purifying and bottling	190 Bottled water	0.084
16	Manufacturing of distilled beverages from agave	182 Tequila	0.078
17	Manufacturing of alcoholic beverages from grapes	184 Brandy, 185 Table wine	0.053
18	Manufacturing of rum and other distilled beverages from cane	183 Rum	0.050
<b>4 Bakery products and tortilla manufacturing</b>			<b>1.214</b>
19	Corn tortilla manufacturing and nixtamal milling	149 Tortilla corn	0.670
20	Traditional baking	140 Sweet bread in bulk, 141 White bread in bulk	0.311
21	Industrial baking	142 Packaged white bread, 143 Packaged sweet bread and cakes	0.150
22	Cookie, cracker, and pasta manufacturing	144 Pasta for soup, 145 Crackers, 146 Biscuits, 147 Wheat tortillas	0.083
<b>Non-food merchandise</b>			
<b>1 Machinery manufacturing</b>			<b>0.474</b>
1	Air conditioning and heating equipment manufacturing	456 Air conditioning units	0.156
2	Industrial and commercial refrigeration equipment manufacturing	455 Industrial fridges	0.123
3	Farming machinery and equipment manufacturing	437 Agricultural tractors, 438 Other agricultural machines	0.081
4	Machinery and equipment for food and beverages	440 Machinery and equipment for food and beverages	0.033
5	Lifting and handling machinery and equipment manufacturing	444 Derricks, 445 Elevators and freight lifts	0.031
6	Other general purpose machinery	449 Other non-electrical machinery and	0.027
7	Welding and soldering equipment manufacturing	413 Solders, 457 Welding guns and electric ovens	0.014
8	Construction machinery and equipment manufacturing	441 Machinery for construction and mining industries	0.009
<b>2 Miscellaneous manufacturing</b>			<b>0.443</b>
9	Manufacturing of writing, painting and drawing goods, and office supplies manufacturing	500 Pens and pencils, 501 Other school and office supplies	0.192
10	Manufacturing of nonelectronic medical, dental and laboratory equipment	497 Medical equipment and devices	0.148
11	Candles manufacturing	502 Candles and votive candles	0.036
12	Other manufacturing industries	505 Other Manufacturing	0.031
13	Medical disposable material manufacturing	206 Healing material	0.019
14	Toys manufacturing	377 Plastic toys	0.017
<b>5 Dairy products manufacturing</b>			<b>1.753</b>
23	Fluid milk manufacturing	110 Pasteurized milk	0.941
24	Dairy products and lactic ferments manufacturing	111 Asadero and oaxaca cheese, 112 Fresh cheese, 113 Chihuahua or manchego cheese, 114 American cheese, 115 Other cheeses, 116 Milk cream, 117 Butter, 122 Yogurt	0.389
25	Dry, condensed and evaporated milk manufacturing	118 Dry milk, 119 Evaporated milk, 120 Infant formula, 121 Condensed milk	0.245
26	Ice cream and popsicle manufacturing	180 Ice cream	0.178
<b>6 Other food manufacturing</b>			<b>0.911</b>
27	Snack food manufacturing	181 Snacks, chips and the like	0.301
28	Manufacturing of flavoring concentrates, powders, syrup and essences for beverages	178 Concentrates for soft drinks	0.243
29	Seasoning and dressing manufacturing	134 Salt, 135 Mayonnaise, 137 Other dressings, 136 Other seasonings	0.098
30	Coffee processing (cleaning, pulp removal, and drying)	150 Golden coffee	0.087
31	Instant coffee manufacturing	152 Instant coffee	0.083
32	Roasted and milled coffee manufacturing	151 Roasted coffee	0.049
33	Other food manufacturing	167 Packaged honey bee	0.049
<b>7 Sugar, chocolate and confectionery products manufacturing</b>			<b>0.368</b>
34	Cane sugar manufacturing	153 Sugar	0.339
35	Chocole and related products manufacturing	165 Chocolate tablet, 166 Chocolate powder	0.029
<b>8 Animal food manufacturing</b>			<b>0.281</b>
36	Animal food manufacturing	159 Food for birds, 160 Fodder for pigs, 161 Fodder for cattle, 162 Food for other cattles, 163 Pet food	0.281
<b>9 Fruits, vegetables, stews and prepared meals freezing</b>			<b>0.210</b>
37	Fruits and vegetables dehydration	124 Dehydrated fruits and vegetables	0.210
<b>10 Seafood preparation and packaging</b>			<b>0.078</b>
38	Seafood preparation and packaging	169 Canned sardine, 170 Canned tuna, 171 Other packaged fish and seafood	0.078

**Table 2. Analyzed Industries at the Producer-Wholesale Segment (cont.)**

Non-food Merchandise							
Subsector (3-digits NAICs)	Industry class (6-digit NAICs)	PPI Items	Weight in the PPI (%)	Subsector (3-digits NAICs)	Industry class (6-digit NAICs)	PPI Items	Weight in the PPI (%)
<b>3</b>	<b>Electronic devices, computers and electrical products manufacturing</b>		<b>3.495</b>	<b>5</b>	<b>Petroleum and coal products and plastic manufacturing</b>		<b>1.711</b>
15	Computer and peripheral equipment manufacturing	466 Computers and related accessories	1.850	43	Plastic bottles manufacturing	375 Plastic containers	0.438
16	Electronic components manufacturing	469 Parts for electronic equipment	0.478	44	Tires and inner tubes manufacturing	366 Car tires, 367 Truck tires, 368 Other tires	0.249
17	Major household manufacturing	443 Water heaters, 459 Stoves, 460 Fridges, 461 Washing machines	0.387	45	Manufacturing of other non-reinforced plastic products for industrial use	381 Other plastic products	0.236
18	Manufacturing and reproducing magnetic and optical media	467 Music records and cassettes	0.189	46	Flexible plastic bags and films manufacturing	376 Polyethylene bags and films	0.234
19	Electric motors and generators manufacturing	453 Electric engines, 454 Stations and other control equipment	0.147	47	Reinforced and non-reinforced plastic auto parts manufacturing	380 Plastic items and replacements for the automotive industry	0.180
20	Electric power distribution equipment and apparatus manufacturing	452 Transformers	0.138	48	Polystyrene foam and polystyrene products manufacturing	379 Plastic clutery and other plastic products for kitchen and cleaning	0.116
21	Audio and video equipment manufacturing	464 Televisions, 465 Modular equipment, radios and recorders	0.104	49	Lubricating oils and greases manufacturing	284 Lubricant oils	0.081
22	Current-carrying wiring manufacturing	473 Wires and cables with insulation	0.060	50	Urethane foam and urethane products manufacturing	373 Plates and plastic profiles	0.064
23	Manufacturing of plugs, contacts, fuses and other accessories for electric installations	474 Other electrical equipment	0.039	51	Manufacturing of pipes, pipe fitting and packaging tubes manufacturing	374 Plastic Pipes	0.046
24	Telephone equipment manufacturing	468 Land line appliances	0.039	52	Other rubber products manufacturing	370 Rubber sole and footwear, 372 Other rubber products	0.041
25	Small household appliances manufacturing	462 Beater and blenders, 463 Irons and other small electric appliances	0.036	53	Rubber and plastic bands and hoses manufacturing	369 Hoses, 371 Rubber bands	0.018
26	Accumulators and batteries manufacturing	470 Accumulators, 471 Battery	0.017	54	Asphalt products manufacturing	285 Asphalt, 286 Asphalt mixtures	0.010
27	Light bulbs manufacturing	472 Light bulbs and tubes	0.012				
<b>4</b>	<b>Chemical manufacturing</b>		<b>3.334</b>	<b>6</b>	<b>Paper manufacturing and printing</b>		<b>1.463</b>
28	Pharmaceutical preparation manufacturing	330 Antibiotics, 331 Analgesics, 332 Gastrointestinal remedies, 333 Contraceptives and hormonal based medicine, 334 Nutritional supplements, 335 Cardiovascular medicine, 336 Expectorants and decongestants, 337 Flu remedies, 338 Veterinary products, 339 Dermatological, 340 Other medicines	0.935	55	Manufacturing of paper bags, and coated and treated cellulose products	265 Miscellaneous and sticky paper, 268 Paper bags and sacks	0.404
29	Adhesives manufacturing	355 Bases, sealants and other finishes materials, 356 Adhesives, 357 Waterproofing	0.378	56	Books, newspapers and magazines printing	272 Magazines, 273 Newspapers, 274 Textbooks, 275 Other books	0.278
30	Other basic organic chemical products manufacturing	301 Citric, acetic and other organic acids, 302 Terephthalic acid and other esters, 303 Alcohols, 304 Other organic chemical products, 305 Carbonates, 306 Caustic soda, 307 Oxides, 308 Chlorine 309 Hydrogen fluoride and other inorganic acids, 310 Sulfates, 311 Other inorganic chemicals products	0.364	57	Paperboard containers manufacturing	269 Cardboard boxes and cartons	0.270
31	Soaps, cleaners and dentifrices manufacturing	341 Fabric softeners, 342 Detergents, 343 Laundry soap, 344 Toilet soap, 345 Toothpaste, 346 Whiteners and cleaners	0.354	58	Paper manufacturing from pulp	260 Printing paper, 261 Kraft and semikraft paper, 262 Toilet paper, 264 Napkins	0.264
32	Cosmetics, perfumes and other toilet	347 Lotions and perfumes, 348 Hair	0.277	59	Disposable diapers and sanitary products manufacturing	213 Disposable diapers, 214 Sanitary towels	0.195
33	Chemical fibers manufacturing	325 Polyester fiber, 326 Nylon fiber, 327 Rayon fiber, 328 Acrylic fibers, 329 Other synthetic fibers	0.225	60	Paperboard manufacturing from pulp	266 Cardboard, 267 Paperboard and poster	0.034
34	Paints and coatings manufacturing	353 Commercial paints, 354 Varnishes and	0.208	61	Other paperboard and paper products manufacturing	271 Other products made of paper and cardboard	0.017
35	Synthetic resins manufacturing	319 Polypropylene, 320 Polyvinyl chloride (PVC), 321 Polystyrene resin, 322 Other resins, 323 Plasticizers	0.195				
36	Other chemical products manufacturing	359 Polishes and polishers, 360 Air fresheners, 361 Scented oils, 362 Tallows, 364 Antioxidants and other chemicals	0.119	<b>7</b>	<b>Wood and furniture product manufacturing</b>		<b>0.999</b>
37	Pesticides and other agricultural chemical manufacturing, except fertilizers	352 Pesticides	0.117	62	Wood container and pallet manufacturing	255 Doors, windows and closets, 256 Wooden boxes, 257 Construction frames and hardwood floors	0.367
38	Synthetic dyes and pigments manufacturing	298 Dyes and pigments	0.056	63	Boards and planks sawing	245 Pine wood, 246 Other woods	0.279
39	Fertilizers manufacturing	312 Urea, 313 Ammonium sulfate, 314 Ammonium phosphate, 315 Superphosphate, 316 Ammonium nitrate, 317 Phosphoric acid, 318 Other fertilizers	0.039	64	Furniture manufacturing, except fitted kitchens, bathroom modular furniture, office furniture and shelvings	250 Bedrooms furniture, 251 Living rooms, 252 Dining tables	0.123
40	Printing inks manufacturing	358 Inks	0.031	65	Office furniture and shelving manufacturing	258 Wood furniture for office and shops	0.080
41	Synthetic rubbers manufacturing	324 Synthetic rubber	0.028	66	Wood laminates and fiberboard manufacturing	247 Plywood, 248 Linoleum, 249 Chipboard	0.066
42	Industrial gas manufacturing	299 Carbon dioxide, 300 Oxygen	0.006	67	Mattresses manufacturing	254 Mattresses	0.062
				68	Fitted kitchens and bathroom modular furniture manufacturing	253 Furniture for kitchen	0.021

**Table 2. Analyzed Industries at the Producer-Wholesale Segment (cont.)**

Non-food Merchandise							
(3-digits NAIcs)	Industry class (6-digit NAIcs)	PPI Items	Weight in the PPI (%)	(3-digits NAIcs)	Industry class (6-digit NAIcs)	PPI Items	Weight in the PPI (%)
<b>8 Primary and fabricated metal and nonmetallic product manufacturing</b>				<b>9 Textile mills, apparel and leather</b>			
69	Other iron and steel products manufacturing	401 Steel ingots and billets for continuous casting, 402 Steel plate, 403 Reinforced bar, 404 Iron and steel profiles, 405 Wire rod, 406 Steel sheet	0.824	102	Other cut and sew clothing manufacturing	225 Blouses, 226 Women coordinates, 227 Dresses, 228 Trousers for women, 229 Skirts, 230 Trousers for children, 231 Dresses for girls, 232 Baby clothes, 233 Children t shirts	0.257
70	Manufacturing of cement and products based on cement in integrated plants	387 Cement	0.457	103	Footwear manufacturing	241 Womens Shoes, 242 Mens Shoes, 243 Shoes for children	0.206
71	Non-refractory tiles manufacturing	390 Ceramic floor tiles	0.444	104	Cut and sew apparel contractors	221 Trousers for men, 222 Jackets, 223 Suits	0.202
72	Ready-mix concrete manufacturing	398 Ready-mix concrete	0.238	105	Broadwoven fabrics manufacturing	195 Cotton fabrics, 196 Cashmeres and cloths, 197 Synthetic fibers, 198 Dyed and printed fabrics, 199 Other soft fiber fabrics	0.193
73	Glass containers manufacturing	384 Glass containers	0.178	106	Natural soft fibers preparation and spinning	194 Threads for sewing	0.143
74	Other nonferrous metals smelting and refining	414 Lead, tin and zinc products, 415 Refine gold, 416 Refined silver	0.172	107	Knitted fabrics manufacturing	220 Knitted fabric	0.127
75	Iron and steel pipes and tubes manufacturing	407 Tubes and iron and steel poles	0.171	108	Men's and boys' cut and sew apparel manufacturing	218 T shirts, 219 Underpants for men	0.122
76	Light gauge metal containers manufacturing	430 Metal containers	0.148	109	Cut and sew uniforms manufacturing, mass production	234 Uniforms, 235 Sportswear, 236 Other outerwear	0.096
77	Secondary lamination of copper	409 Copper wires and cables, 410 Copper pipes, 411 Copper sheets and profiles	0.138	110	Cut and sew curtains, linen and similar products manufacturing	208 Towels, 209 Quilts, 210 Blankets, 211 Sheets, tablecloths and napkins	0.092
78	Glass manufacturing	382 Flat glass, 383 Glass and crystal for the automotive industry	0.134	111	Leather and hide tanning and finishing	238 Fur and skin clothing	0.087
79	Metal structures manufacturing	421 Metallic structures	0.130	112	Fabric upper footwear manufacturing	244 Tennis Shoes	0.067
80	Forged and stamped metal products manufacturing	431 Bottle caps	0.124	113	Knitted socks and hosiery manufacturing	215 Stockings and tights, 216 Socks	0.040
81	Other metal products manufacturing	435 Sheets cuts and folding, 436 Cutting and folding of other metal products, 451 Filters	0.121	114	Cut and sew textile bags manufacturing	200 Stiff-fiber threads and fabrics	0.038
82	Metal valves manufacturing	447 Valves for domestic use, 448 Valves for industrial use	0.111	115	Knitted outerwear manufacturing	217 Sweaters	0.036
83	Gypsum and gypsum products manufacturing	393 Gypsum and similar products	0.108	116	Coated fabrics manufacturing	201 Waterproof fabrics	0.034
84	Aluminum basic industry	412 Aluminum tuning and rolling	0.083	<b>10 Motorvehicles</b>			
85	Heavy gauge metal tanks manufacturing	422 Metal tanks	0.080	117	Automobiles and pickup trucks manufacturing	475 Vehicles	2.620
86	Vitreous china, fine earthenware, and other pottery product manufacturing	389 Bathroom furniture and items	0.076	118	Trucks and truck tractors manufacturing	476 Trucks, 477 Buses, 478 Tractor trucks	2.014
87	Wire, wire products and springs	427 Nails, 432 Iron and steel wires	0.076	119	Automotive vehicle engines and engine	480 Vehicle engines, 481 Parts for vehicle	0.660
88	Lime manufacturing	394 Slaked lime	0.067	120	Motor vehicle electrical and electronic equipment and parts manufacturing	487 Engines additional to the automobile electric system, 488 Alternators, 489 Spark plugs and other parts for the electrical system, 490 Automotive electrical harnesses	0.329
89	Iron and steel parts molding by casting	429 Molted metal castings and molds	0.065	121	Other automotive vehicle parts	491 Seats for motor vehicles, radiators	0.217
90	Non-refractory bricks manufacturing	391 Bricks	0.065	122	Motor vehicle transmission system parts manufacturing	482 Transmissions, 483 Powered axles and related parts	0.193
91	Metal coating and finishings	428 Enameled metal parts	0.061	123	Motor vehicle bodies and trailers manufacturing	479 Vehicle bodies	0.156
92	Other concrete product manufacturing	400 Other concrete products	0.058	124	Automotive vehicle steering and suspension system parts manufacturing	484 Springs and other suspension parts, 485 shock absorbers	0.155
93	Nonpowered metal hand tools manufacturing	424 Shaving razors, 425 Hand tools	0.055	125	Automotive vehicle brake system parts manufacturing	486 Brakes and related parts	0.093
94	Copper smelting and refining	408 Refined copper	0.054	126	Motor vehicle seating and interior trim manufacturing	212 Car trims	0.057
95	Iron works products manufacturing	420 Stairs and other blacksmithing products	0.049				
96	Household glass goods manufacturing	386 Glassware	0.040				
97	Other nonmetallic mineral products manufacturing	395 Asbestos products	0.035				
98	Manufacturing of cement and concrete pipes and blocks	399 Concrete blocks	0.028				
99	Industrial boilers manufacturing	442 Cauldron and industrial furnaces	0.027				
100	Metal fittings and locks manufacturing	434 Hinges, padlocks and locks	0.018				
101	Metal kitchen utensils manufacturing	423 Metal cutlery, 433 Kitchen batteries	0.014				

Source: INEGI, own estimations.

 Studied Price series
  Price series with unit root
  Price series with no variance
  Price series with total correspondence

**Table 3. Descriptive Statistics for Price Changes, Producer-Wholesale Segment**

Industry category	Industries in the sample	Weight in the INPP (%)	Mean frequency of price changes (as % of all months in sample)					
			Wholesale			Inputs		
			Increments	Decrements	No change	Increments	Decrements	No change
<b>Manufactured non-food products, three digit NAICS, subsector</b>								
<i>Chemical manufacturing</i> <sup>1/</sup>	14	2.399	56.2	28.3	15.6	65.1	34.9	0.0
<i>Electronic devices, computers and electrical products manufacturing</i> <sup>2/</sup>	12	3.306	51.5	32.4	16.1	65.4	33.4	1.2
<i>Machinery manufacturing</i> <sup>3/</sup>	8	0.474	49.1	34.5	16.4	62.5	37.5	0.0
<i>Miscellaneous manufacturing</i> <sup>4/</sup>	6	0.443	54.0	26.7	19.3	66.7	33.3	0.0
<i>Motor vehicles</i> <sup>5/</sup>	10	6.495	50.5	33.1	16.4	65.0	35.0	0.0
<i>Paper manufacturing and printing</i> <sup>6/</sup>	7	1.463	52.3	16.1	31.6	71.7	27.9	0.4
<i>Petroleum, coproducts and plastic manufacturing</i> <sup>7/</sup>	12	1.711	49.9	25.5	24.6	63.8	33.8	2.4
<i>Primary and fabricated metal and nonmetallic mineral product manufacturing</i> <sup>8/</sup>	30	4.076	52.9	25.9	21.2	65.4	34.6	0.1
<i>Textile mills, apparel and leather</i> <sup>9/</sup>	11	0.952	49.3	25.1	25.7	67.4	32.3	0.3
<i>Wood and furniture products manufacturing</i> <sup>10/</sup>	6	0.631	53.4	27.6	19.0	60.9	30.7	8.4
<b>Total non-food products</b>	<b>116</b>	<b>21.950</b>	<b>51.9</b>	<b>27.5</b>	<b>20.6</b>	<b>65.4</b>	<b>33.3</b>	<b>1.3</b>
<b>Processed food products, four digit NAICS, industry group</b>								
<i>Bakery products and tortilla manufacturing</i>	4	1.214	75.4	11.6	13.0	62.2	37.8	0.0
<i>Beverage and tobacco manufacturing</i>	7	1.870	55.2	17.0	27.9	66.0	33.7	0.2
<i>Diary products and lactic ferments manufacturing</i>	4	1.082	49.8	5.3	44.9	62.9	36.9	0.2
<i>Fruits, vegetables, stews and prepared meals preserving</i>	1	0.210	78.2	20.1	1.7	57.7	42.3	0.0
<i>Grain and seed milling, and fats and oils manufacturing</i>	5	1.824	38.0	15.5	46.5	56.2	33.5	10.4
<i>Livestock slaughtering and processing</i>	4	1.905	68.1	31.6	0.3	59.6	40.4	0.0
<i>Other food manufacturing</i>	7	0.911	38.9	13.1	48.1	54.2	45.7	0.1
<i>Seafood preparation and packaging</i>	1	0.078	67.8	32.2	0.0	54.8	45.2	0.0
<i>Sugar, chocolate and confectionery products manufacturing</i>	2	0.368	56.9	34.3	8.8	63.0	32.2	4.8
<i>Animal food manufacturing</i>	1	0.281	65.3	29.7	5.0	72.0	28.0	0.0
<b>Total processed food products</b>	<b>36</b>	<b>9.742</b>	<b>59.4</b>	<b>21.0</b>	<b>19.6</b>	<b>60.9</b>	<b>37.6</b>	<b>1.6</b>

Source: Own estimations.

Notes: 1/ Chemical manufacturing (NAICS 325); 2/ Computer and electronic product manufacturing (NAICS 334), electrical equipment, appliance, and component manufacturing (NAICS 335); 3/ Machinery manufacturing (NAICS 333); 4/ Miscellaneous manufacturing (NAICS 339); 5/ Transportation equipment manufacturing (NAICS 336); 6/ Paper manufacturing (NAICS 332) and printing and related supplies (NAICS 323); 7/ Petroleum and coal products manufacturing (NAICS 324), plastics and rubber products manufacturing (NAICS 326); 8/ Non-metallic mineral product manufacturing (NAICS 327), primary metal manufacturing (NAICS 331), fabricated metal products (NAICS 332); 9/ Textile mills (NAICS 313), textile product mills (NAICS 314), apparel manufacturing (NAICS 315) leather and product manufacturing (NAICS 316); 10/ Wood product manufacturing (NAICS 321) and furniture related product manufacturing (NAIC 337).

**Table 4. Examples of Weight Employed in the Construction of Wholesale Prices Employed in the Wholesale-Consumer Segment**

<i>CPI item</i>	<i>PPI item</i>	<i>Weight in the PPI private consumption index (%)<sup>1/</sup></i>	<i>Normalized weight employed in the construction of wholesale price series (%)</i>
<i>Other fruits</i>	Strawberry	0.01	5.49
	Mango	0.13	56.58
	Other fruits	0.09	37.93
	<b>Total</b>	<b>0.23</b>	<b>100</b>
<i>Fresh and pasteurized milk</i>	Pasteurized milk	1.15	82.4
	Unpasteurized milk	0.25	17.6
	<b>Total</b>	<b>1.4</b>	<b>100</b>






**Source:** Own estimations.

**Notes:** 1/ Weights reported by INEGI for the construction of the PPI, domestic demand price index. These weights represent the approximate participation of each PPI item consumed by private residents in Mexico.

**Table 5. Analyzed Products at the Wholesale-Consumer Segment**

Raw food and processed food products				Non-food merchandise				
Group	Item	Weight in the CPI (%)	Group	Item	Weight in the CPI (%)	Group	Item	Weight in the CPI (%)
<b>1</b>	<b>Fresh meat and other animal products</b>	<b>4.261</b>	<b>6</b>	<b>Fresh Vegetables</b>	<b>2.307</b>	<b>1</b>	<b>Personal care supplies</b>	<b>4.544</b>
1	Beef	1.776	57	Tomato	0.495	1	Hair products	0.688
2	Chicken	1.323	58	Bean	0.280	2	Lotions and perfumes	0.665
3	Pork	0.694	59	Potatoes and other tubers	0.247	3	Toilet paper and tissue paper	0.587
4	Fish	0.323	60	Other vegetables	0.204	4	Toothpaste	0.399
5	Shrimp	0.088	61	Onion	0.170	5	Baby diapers	0.390
6	Beef offal	0.040	62	Green tomato	0.131	6	Antiperspirants and deodorants	0.373
7	Other seafood	0.018	63	Zucchini	0.126	7	Skin care creams	0.319
<b>2</b>	<b>Bakery products, tortilla and cereals</b>	<b>3.595</b>	64	Lettuce and cabbage	0.105	8	Soap	0.310
8	Corn tortilla	1.540	65	Other fresh chillies	0.091	9	Sanitary towels	0.216
9	Sweet bread	0.533	66	Chayote fruit	0.084	10	Knives and razors	0.195
10	White bread	0.295	67	Serrano chile	0.076	11	Make-up articles	0.165
11	Cornflakes	0.206	68	Carrot	0.069	12	Napkins	0.147
12	Sliced bread	0.196	69	Nopal	0.067	13	Other toiletries	0.088
13	Biscuits	0.166	70	Poblano chile	0.046	<b>2</b>	<b>Apparel</b>	<b>3.419</b>
14	Rice	0.149	71	Cucumber	0.040	14	Pants for men	0.417
15	Pasta for soup	0.124	72	Green beans	0.030	15	School uniforms	0.411
16	Wheat tortillas	0.094	73	Dried chili	0.027	16	Shirts	0.352
17	Crackers	0.069	74	Peas	0.019	17	Trousers for women	0.323
18	Cakes, pastries and packaged sweet bread	0.055	<b>7</b>	<b>Sugar, coffee and Soft drinks</b>	<b>1.819</b>	18	Blouses and shirts for women	0.315
19	Dough and corn flour	0.050	75	Bottled softdrinks	1.091	19	Outerwear	0.273
20	Cakes and pastries in bulk	0.049	76	Bottled water	0.400	20	Dresses, skirts and pants for girls	0.265
21	Corn	0.036	77	Sugar	0.180	21	Baby clothes	0.193
22	Wheat flour	0.033	78	Instant coffee	0.117	22	Pants for children	0.133
<b>3</b>	<b>Eggs, dairy and related products</b>	<b>3.293</b>	79	Roasted coffee	0.030	23	Dresses and skirts for women	0.132
23	Pasteurized and fresh milk	1.429	<b>8</b>	<b>Fresh Fruits</b>	<b>1.253</b>	24	Shirts and t-shirts for children	0.119
24	Egg	0.614	80	Apple	0.227	25	Underwear for women	0.117
25	Fresh cheese	0.222	81	Lemon	0.207	26	Formal suits	0.100
26	Yogurt	0.218	82	Bananas	0.170	27	Underwear for children	0.057
27	Asadero and Oaxaca cheese	0.185	83	Other fruits	0.133	28	Underwear for men	0.055
28	Other cheeses	0.166	84	Avocado	0.113	29	Socks and stockings	0.041
29	Milk cream	0.120	85	Papaya	0.078	30	Other womens clothing	0.037
30	Powder milk	0.107	86	Grapes	0.074	31	Other men's clothing	0.029
31	Manchego and Chihuahua cheese	0.085	87	Peach	0.056	32	Socks	0.023
32	Evaporated and condensed milk and infant formula	0.060	88	Cantaloupe	0.046	33	Baby shirts	0.016
33	Ice Cream	0.036	89	Guava	0.041	34	Stockings and pantyhose	0.012
34	Butter	0.027	90	Orange	0.035	<b>3</b>	<b>Motor vehicle parts and equipment</b>	<b>3.381</b>
35	Yellow cheese	0.023	91	Pear	0.033	35	Automobiles	2.896
<b>4</b>	<b>Alcoholic beverages and tobacco</b>	<b>2.633</b>	92	Watermelon	0.025	36	Tires	0.211
36	Beer	1.554	93	Pineapple	0.014	37	Lubricant	0.096
37	Cigarettes	0.685	<b>9</b>	<b>Processed meat and animal products</b>	<b>1.005</b>	38	Bicycles and motorcycles	0.088
38	Tequila	0.154	94	Spicy pork sausage	0.453	39	Other automobile parts	0.063
39	Table wine	0.078	95	Ham	0.197	40	Car accumulators	0.028
40	Brandy	0.062	96	Canned tuna and sardines	0.133	<b>4</b>	<b>Housekeeping supplies</b>	<b>2.534</b>
41	Other liquors	0.055	97	Sausages	0.120	41	Detergents	0.764
42	Rum	0.045	98	Dried and cold meats	0.046	42	Softeners and cleaners	0.522
<b>5</b>	<b>Other foods</b>	<b>2.460</b>	99	Other conserved fish and seafood	0.037	43	Bleach and cleaning products	0.212
43	Other cooked food	0.941	100	Bacon	0.018	44	Laundry soap	0.138
44	Roasted chicken	0.389	<b>10</b>	<b>Processed fruits and vegetables</b>	<b>0.521</b>	45	Brooms, fibers and scourers	0.130
45	Edible oils and vegetable fats	0.245	101	Packaged juices or nectars	0.203	46	Pesticides	0.099
46	Barbacoa and birria	0.178	102	Canned chiles, moles and sauces	0.101	47	Air fresheners	0.090
47	Pizzas	0.162	103	Canned vegetables	0.059	48	Quilts and blankets	0.084
48	Barbecued pork	0.129	104	Other pulses	0.056	49	Light bulb	0.066
49	Concentrates for soft drinks	0.091	105	Processed beans	0.054	50	Other kitchenware	0.066
50	Fried potatoes and similar	0.074	106	Other preserved fruits	0.022	51	Crockery, glassware and cutlery	0.055
51	Mayonnaise and mustard	0.062	107	Instant soups and tomato puree	0.015	52	Other home textiles	0.052
52	Chocolate	0.049	108	Fruits and vegetables prepared for babies	0.011	53	Cookware	0.051
53	Chicken and salt concentrates	0.047				54	Wax and votive candles	0.043
54	Sweets, caramels and honey	0.045				55	Bed sheets	0.035
55	Powder gelatin	0.027				56	Matches	0.034
56	Other condiments	0.023				57	Pilas	0.033
						58	Towels	0.022
						59	Plastic home utensils	0.021
						60	Curtains	0.019
<b>5</b>	<b>Footwear and accessories</b>	<b>1.968</b>				<b>5</b>	<b>Footwear and accessories</b>	<b>1.968</b>
61	Tennis shoes	0.626				61	Tennis shoes	0.626
62	Shoes for children	0.390				62	Shoes for children	0.390
63	Shoes for woman	0.352				63	Shoes for woman	0.352
64	Shoes for men	0.305				64	Shoes for men	0.305
65	Handbags, bags and belts	0.137				65	Handbags, bags and belts	0.137
66	Plastic shoes	0.088				66	Plastic shoes	0.088
67	Watches, costume and imitation	0.058				67	Watches, costume and imitation	0.058
68	Other expenses footwear	0.011				68	Other expenses footwear	0.011
<b>6</b>	<b>Furniture and domestic appliances</b>	<b>1.868</b>				<b>6</b>	<b>Furniture and domestic appliances</b>	<b>1.868</b>
69	Televisions	0.331				69	Televisions	0.331
70	Computers	0.297				70	Computers	0.297
71	Fridge	0.187				71	Fridge	0.187
72	Mattresses	0.166				72	Mattresses	0.166
73	Washing machines	0.114				73	Washing machines	0.114
74	Rooms	0.107				74	Rooms	0.107
75	Bedrooms	0.104				75	Bedrooms	0.104
76	Stoves	0.080				76	Stoves	0.080
77	Computers and audio players	0.075				77	Computers and audio players	0.075
78	Dinning and dinette tables	0.065				78	Dinning and dinette tables	0.065
79	Air fans	0.052				79	Air fans	0.052
80	Miscellaneous home furnishings	0.049				80	Miscellaneous home furnishings	0.049
81	Kitchen furniture	0.044				81	Kitchen furniture	0.044
82	Air conditioners	0.043				82	Air conditioners	0.043
83	Video players	0.031				83	Video players	0.031
84	Other appliances	0.031				84	Other appliances	0.031
85	Landline phones	0.024				85	Landline phones	0.024
86	Blenders	0.024				86	Blenders	0.024
87	Microwave	0.017				87	Microwave	0.017
88	Electric irons	0.017				88	Electric irons	0.017
89	Water heaters	0.009				89	Water heaters	0.009
<b>7</b>	<b>Educational and recreative goods and supplies</b>	<b>1.151</b>				<b>7</b>	<b>Educational and recreative goods and supplies</b>	<b>1.151</b>
90	School supplies	0.339				90	School supplies	0.339
91	Other books	0.159				91	Other books	0.159
92	Pet food	0.142				92	Pet food	0.142
93	Newspapers	0.120				93	Newspapers	0.120
94	Textbooks	0.118				94	Textbooks	0.118
95	Photographic material and equipments	0.082				95	Photographic material and equipments	0.082
96	Toys	0.064				96	Toys	0.064
97	Movies, music and videogames	0.061				97	Movies, music and videogames	0.061
98	Magazines	0.037				98	Magazines	0.037
99	Musical instruments and similar articles	0.017				99	Musical instruments and similar articles	0.017
100	Sporting goods	0.012				100	Sporting goods	0.012
<b>8</b>	<b>Medicare commodities</b>	<b>0.800</b>				<b>8</b>	<b>Medicare commodities</b>	<b>0.800</b>
101	Other drugs	0.160				101	Other drugs	0.160
102	Glasses, hearing aids and orthopedic equipment	0.139				102	Glasses, hearing aids and orthopedic equipment	0.139
103	Antibiotics	0.095				103	Antibiotics	0.095
104	Cardiovascular equipment	0.062				104	Cardiovascular equipment	0.062
105	Analgesics	0.062				105	Analgesics	0.062
106	Nutritional supplements	0.052				106	Nutritional supplements	0.052
107	Diabetes medications	0.047				107	Diabetes medications	0.047
108	Gastrointestinal remedies	0.038				108	Gastrointestinal remedies	0.038
109	Healing material	0.028				109	Healing material	0.028
110	Flu remedies	0.028				110	Flu remedies	0.028
111	Homeopathic and naturopathic medicine	0.027				111	Homeopathic and naturopathic medicine	0.027
112	Allergy medications	0.018				112	Allergy medications	0.018
113	Expectorants and decongestants	0.018				113	Expectorants and decongestants	0.018
114	Anti-inflammatory	0.015				114	Anti-inflammatory	0.015
115	Dermatological supplies	0.011				115	Dermatological supplies	0.011

Source: INEGI, own estimations.

 Studied Price series 
  Price series with no correspondence PPI-CPI 
  Price series with no variance 
  Price series with unit root 
  Price series with total correspondence PPI-CPI

**Table 6. Descriptive Statistics for Price Changes, Wholesale-Retail Segment**

Group	Items in sample	Weight in the CPI (%)	Mean frequency of price changes (as % of all months)					
			Consumer			Wholesale		
			Increments	Decrements	No change	Increments	Decrements	No change
<b>Manufactured non-food products</b>								
<i>Apparel</i>	3	0.638	80.89	18.97	0.14	52.72	31.10	16.18
<i>Educational and recreative goods and supplies</i>	6	0.770	84.59	14.64	0.77	66.25	17.15	16.60
<i>Footwear and accesories</i>	2	0.898	82.85	16.95	0.21	45.82	14.02	40.17
<i>Furniture and domestic appliances</i>	9	1.017	62.67	37.28	0.05	40.73	30.13	29.15
<i>Housekeeping supplies</i>	12	1.979	73.74	26.22	0.03	45.68	20.89	33.44
<i>Medicalcare commodities</i>	4	0.439	84.94	15.06	0.00	68.62	17.47	13.91
<i>Motor vehicle parts and equipment</i>	5	4.370	83.18	16.82	0.00	55.48	30.79	13.72
<i>Personal care supplies</i>	11	3.461	72.84	27.16	0.00	43.51	17.80	38.68
<b>Total non-food products</b>	<b>52</b>	<b>13.571</b>	<b>78.21</b>	<b>21.64</b>	<b>0.15</b>	<b>52.35</b>	<b>22.42</b>	<b>25.23</b>
<b>Processed and raw food products</b>								
<i>Alcoholic beverages and tobacco</i>	4	0.828	73.54	26.36	0.10	47.49	21.55	30.96
<i>Bakery products, tortilla and cereals</i>	6	0.703	72.32	27.68	0.00	44.70	18.55	36.75
<i>Eggs, diary and related products</i>	9	2.771	73.59	26.31	0.09	46.07	12.78	41.14
<i>Fresh fruits</i>	13	1.242	53.11	46.89	0.00	55.29	44.16	0.55
<i>Fresh meats and other animal products</i>	6	4.157	65.90	34.10	0.00	60.74	39.26	0.00
<i>Fresh vegetables</i>	13	2.144	54.04	45.96	0.00	53.36	46.64	0.00
<i>Other foods</i>	4	0.406	70.61	29.39	0.00	53.97	27.51	18.51
<i>Processed fruits and vegetables</i>	6	0.466	71.20	28.80	0.00	59.14	30.13	10.74
<i>Processed meat and animal products</i>	4	0.422	69.77	30.23	0.00	47.49	20.71	31.80
<i>Sugar, coffee and soft drinks</i>	5	1.868	74.81	25.10	0.08	51.55	21.67	26.78
<b>Total processed food and raw products</b>	<b>70</b>	<b>15.007</b>	<b>67.89</b>	<b>32.08</b>	<b>0.03</b>	<b>51.98</b>	<b>28.30</b>	<b>19.72</b>

Source: Own estimations.



**Table 7. Asymmetric Pass-Through in the Producer-Wholesale Segment**

Industry Category	Industries by group	Industries with positive asymmetries		Cumulative response						
		Number	Weight in the PPI (%)	0 months	1 month	2 months	3 months	4 months	5 months	6 months
<b>Manufactured non-food products, three digit NAICS, subsector</b>										
<i>Chemical manufacturing</i> <sup>1/</sup>	14	8	1.524	0.138 *	0.276 ***	0.264 ***	0.421 ***	0.417 ***	0.419 ***	0.397 ***
<i>Electronic devices, computers and electrical products manufacturing</i> <sup>2/</sup>	12	6	0.818	0.128 *	0.231 **	0.178 *	0.129	0.220 **	0.207 *	0.167
<i>Machinery manufacturing</i> <sup>3/</sup>	8	4	0.206	0.149 *	0.304 ***	0.355 ***	0.434 ***	0.412 ***	0.398 ***	0.385 ***
<i>Miscellaneous manufacturing</i> <sup>4/</sup>	6	3	0.067	0.115	0.168	0.162	0.276 **	0.365 **	0.369 **	0.387 **
<i>Motor vehicles</i> <sup>5/</sup>	10	5	3.859	0.061	0.284 ***	0.241 ***	0.372 ***	0.486 ***	0.457 ***	0.432 ***
<i>Paper manufacturing and printing</i> <sup>6/</sup>	7	3	0.869	0.306 *	0.161	0.363	0.546 **	0.485 *	0.358	0.246
<i>Petroleum and coal products and plastic manufacturing</i> <sup>7/</sup>	12	5	0.213	0.117 *	0.163 *	0.189 *	0.306 ***	0.264 **	0.258 **	0.230 **
<i>Primary and fabricated metal and nonmetallic mineral product manufacturing</i> <sup>8/</sup>	30	16	2.250	0.222 ***	0.314 ***	0.308 ***	0.320 ***	0.304 ***	0.259 ***	0.241 ***
<i>Textile mills, apparel and leather</i> <sup>9/</sup>	11	5	0.588	0.266 **	0.085	0.217	0.370 *	0.284	0.227	0.196
<i>Wood and furniture products manufacturing</i> <sup>10/</sup>	6	2	0.203	-0.159	0.018	0.103	0.194	0.223	0.147	0.132
<b>Total non-food products</b>	<b>116</b>	<b>57</b>	<b>10.599</b>	<b>0.156 ***</b>	<b>0.228 ***</b>	<b>0.251 ***</b>	<b>0.333 ***</b>	<b>0.336 ***</b>	<b>0.302 ***</b>	<b>0.275 ***</b>
<b>Processed and raw food products, four digit NAICS, industry group</b>										
<i>Bakery products and tortilla manufacturing</i>	4	3	1.064	0.174	0.286 **	0.293 *	0.462 **	0.388 *	0.442 ***	0.297
<i>Beverage and tobacco manufacturing</i>	7	5	1.271	0.013	-0.165 **	-0.041	0.098	0.228 **	0.225 **	0.250 **
<i>Dairy products and lactic ferments manufacturing</i>	4	3	0.776	0.239 **	0.398 ***	0.400 **	0.212	0.292	0.142	0.106
<i>Fruits, vegetables, stews and prepared meals preserving</i>	1	0	0.000	-0.001	0.078	0.094	0.076	0.074	0.074	0.073
<i>Grain and seed milling, and fats and oils manufacturing</i>	5	2	0.329	0.074	0.392 **	0.608 ***	0.620 ***	0.631 ***	0.670 ***	0.587 ***
<i>Livestock slaughtering and processing</i>	4	3	1.734	0.316	0.425	0.866 **	1.028 ***	1.037 ***	1.008 ***	0.970 ***
<i>Other food manufacturing</i>	7	3	0.181	0.052	0.146 ***	0.132 **	0.198 ***	0.223 ***	0.237 ***	0.245 ***
<i>Seafood preparation and packaging</i>	1	1	0.078	0.228 ***	0.238 **	0.221 **	0.109	0.111	0.237 *	0.274 **
<i>Sugar, chocolate and confectionery products manufacturing</i>	2	2	0.368	0.477 ***	0.557 ***	0.565 **	0.642 **	0.661 **	0.658 **	0.648 **
<i>Animal food manufacturing</i>	1	1	0.281	0.968 *	1.325 **	1.744 ***	2.303 ***	2.222 ***	1.984 ***	1.730 ***
<b>Total processed food and Raw products</b>	<b>36</b>	<b>23</b>	<b>6.081</b>	<b>0.164 ***</b>	<b>0.250 ***</b>	<b>0.364 ***</b>	<b>0.438 ***</b>	<b>0.470 ***</b>	<b>0.460 ***</b>	<b>0.424 ***</b>

Source: Own estimations.

Notes: 1/ Chemical manufacturing (NAICS 325); 2/ Computer and electronic product manufacturing (NAICS 334), electrical equipment, appliance, and component manufacturing (NAICS 335); 3/ machinery manufacturing (NAICS 333); 4/ miscellaneous manufacturing (NAICS 339); 5/ Transportation equipment manufacturing (NAICS 336); 6/ Paper manufacturing (NAICS 332) and printing and related supplies (NAICS 323); 7/ Petroleum and coal products manufacturing (NAICS 324), plastics and rubber products manufacturing (NAICS 326); 8/ Non-metallic mineral product manufacturing (NAICS 327), primary metal manufacturing (NAICS 331), fabricated metal products (NAICS 332); 9/ Textile mills (NAICS 313), Textile product mills (NAICS 314), apparel manufacturing (NAICS 315) leather and product manufacturing (NAICS 316); 10/ Wood product manufacturing (NAICS 321) and furniture related product manufacturing (NAIC 337).

Robust standard errors were used to obtain statistical significance. \*\*\*, \*\*, \* indicate statistical significance at 1, 5, and 10 percent levels.

**Table 8. Speed of Price Transmission in the Producer-Wholesale Segment**

Industry category	Positive pass-through							Negative pass-through						
	0 months	1 month	2 months	3 months	4 months	5 months	6 months	0 months	1 month	2 months	3 months	4 months	5 months	6 months
<b>Manufactured non-food products, three-digit NAICS, subsector</b>														
<i>Chemical manufacturing</i> <sup>1/</sup>	0.47	0.64	0.81	0.97	0.98	0.99	1.00	0.40	0.93	0.80	1.08	1.05	1.06	1.00
<i>Electronic devices, computers and electrical products manufacturing</i> <sup>2/</sup>	0.43	0.84	0.82	0.91	0.98	0.99	1.00	0.42	0.61	0.93	0.98	0.98	0.98	1.00
<i>Machinery manufacturing</i> <sup>3/</sup>	0.27	0.58	0.72	0.88	0.89	0.96	1.00	0.21	0.28	0.90	1.06	1.15	1.08	1.00
<i>Miscellaneous manufacturing</i> <sup>4/</sup>	-0.04	0.23	0.39	0.84	0.92	0.98	1.00	0.51	0.75	0.61	0.23	0.56	0.79	1.00
<i>Motor vehicles</i> <sup>5/</sup>	0.21	0.79	0.71	0.92	0.89	0.98	1.00	0.36	0.17	0.75	0.79	0.91	0.96	1.00
<i>Paper manufacturing and printing</i> <sup>6/</sup>	0.47	0.61	0.80	0.92	0.94	0.93	1.00	1.17	1.19	0.61	1.02	1.13	1.09	1.00
<i>Petroleum and coal products and plastic manufacturing</i> <sup>7/</sup>	0.55	0.96	0.89	0.99	0.97	1.00	1.00	0.14	0.74	0.79	1.01	0.99	1.01	1.00
<i>Primary and fabricated metal and nonmetallic mineral product manufacturing</i> <sup>8/</sup>	0.61	0.93	0.90	0.92	0.94	0.97	1.00	0.46	0.62	0.71	0.94	0.97	0.98	1.00
<i>Textile mills, apparel and leather</i> <sup>9/</sup>	0.57	0.74	0.88	0.96	0.98	0.99	1.00	0.48	0.50	-0.07	0.40	0.63	0.82	1.00
<i>Wood and furniture products manufacturing</i> <sup>10/</sup>	0.40	0.69	0.88	0.92	0.92	0.93	1.00	0.75	1.48	0.96	1.02	0.77	0.88	1.00
<b>Total non-food products</b>	<b>0.50</b>	<b>0.71</b>	<b>0.80</b>	<b>0.93</b>	<b>0.95</b>	<b>0.98</b>	<b>1.00</b>	<b>0.44</b>	<b>0.68</b>	<b>0.76</b>	<b>0.99</b>	<b>0.98</b>	<b>0.99</b>	<b>1.00</b>
<b>Processed and raw food products, four-digit NAICS, industry group</b>														
<i>Bakery products and tortilla manufacturing</i>	0.55	0.69	0.77	0.92	0.93	1.02	1.00	0.38	0.10	0.01	-0.18	0.26	0.34	1.00
<i>Beverage and tobacco manufacturing</i>	0.34	0.67	0.76	0.90	0.93	0.97	1.00	-0.12	-0.18	0.13	1.05	1.01	1.05	1.00
<i>Dairy products and lactic ferments manufacturing</i>	0.61	0.79	1.15	1.20	1.21	1.02	1.00	0.28	0.25	0.57	0.89	0.92	1.01	1.00
<i>Fruits, vegetables, stews and prepared meals preserving</i>	-0.07	0.53	0.75	0.82	0.88	0.94	1.00	-0.14	-0.13	0.08	0.54	0.71	0.86	1.00
<i>Grain and seed milling, and fats and oils manufacturing</i>	0.30	0.96	1.07	0.94	0.98	0.99	1.00	-0.30	0.33	0.92	0.92	1.03	1.01	1.00
<i>Livestock slaughtering and processing</i>	0.42	0.58	0.78	0.89	0.93	0.97	1.00	0.19	0.45	0.87	0.88	0.93	0.97	1.00
<i>Other food manufacturing</i>	0.18	0.41	0.48	0.71	0.83	0.93	1.00	0.36	0.69	0.76	0.84	0.88	0.95	1.00
<i>Seafood preparation and packaging</i>	0.68	0.68	0.62	0.44	0.54	0.86	1.00	0.38	0.33	0.26	0.51	0.78	0.86	1.00
<i>Sugar, chocolate and confectionery products manufacturing</i>	0.67	0.62	0.75	0.91	0.97	0.99	1.00	0.24	0.10	0.34	0.66	0.81	0.91	1.00
<b>Total processed food and raw products</b>	<b>0.37</b>	<b>0.63</b>	<b>0.79</b>	<b>0.90</b>	<b>0.93</b>	<b>0.97</b>	<b>1.00</b>	<b>0.19</b>	<b>0.36</b>	<b>0.60</b>	<b>0.83</b>	<b>0.94</b>	<b>0.97</b>	<b>1.00</b>

Source: Own estimations.




Notes: 1/ Chemical manufacturing (NAICS 325); 2/ Computer and electronic product manufacturing (NAICS 334), electrical equipment, appliance, and component manufacturing (NAICS 335); 3/ machinery manufacturing (NAICS 333); 4/ miscellaneous manufacturing (NAICS 339); 5/ Transportation equipment manufacturing (NAICS 336); 6/ Paper manufacturing (NAICS 332) and printing and related supplies (NAICS 323); 7/ Petroleum and coal products manufacturing (NAICS 324), plastics and rubber products manufacturing (NAICS 326); 8/ Non-metallic mineral product manufacturing (NAICS 327), primary metal manufacturing (NAICS 331), fabricated metal products (NAICS 332); 9/ Textile mills (NAICS 313), Textile product mills (NAICS 314), apparel manufacturing (NAICS 315) leather and product manufacturing (NAICS 316); 10/ Wood product manufacturing (NAICS 321) and furniture related product manufacturing (NAIC 337).

**Table 9. Asymmetric Pass-Through by Item in the Producer-Wholesale Segment**

Group	Activity class (6-digit NAICS)	Item	Weight in the PPI (%)	Asymmetry in price transmission	Group	Activity class (6-digit NAICS)	Item	Weight in the PPI (%)	Asymmetry in price transmission
<b>1 Bakery products and Tortilla manufacturing</b>					<b>5 Grain and seed milling, and fats and oils manufacturing</b>				
	<i>Traditional baking</i>					<i>Corn flour manufacturing</i>			
		Sweet bread in bulk	0.4195	0.646 ***			Corn flour	1.3728	-0.184
		White bread in bulk	0.2910	0.717 ***		<i>Edible vegetable fats and oil manufacturing</i>			
	<i>Industrial baking</i>						Edible vegetable oil	0.0139	0.849 *
		Packaged muffins and cakes	0.0362	0.536 *			Vegetable butter and margarine	0.1485	1.321 ***
		Sliced bread	0.1933	0.560 *		<i>Breakfast cereals manufacturing</i>			
	<i>Cookie, cracker, and pasta manufacturing</i>						Corn flakes	0.0963	1.279 ***
		Cracker	0.0357	0.584 **		<i>Starch and other starch products manufacturing</i>			
		Pasta soup	0.0439	0.586 **			Cereal starches	0.0770	0.563 *
		Salad cookies	0.0153	0.577 **	<b>6 Livestock slaughtering and processing</b>				
		Sweet cookies	0.0243	0.579 **		<i>Livestock, poultry and other edible animals slaughtering</i>			
	<i>Corn tortilla manufacturing and nixtamal milling</i>						Beef carcasses	0.0317	-0.066
		Corn tortillas	0.6519	0.009			Bird carcasses	0.1157	-0.137 *
<b>2 Beverage and tobacco manufacturing</b>							Pork carcasses	0.0235	-0.069
	<i>Soft drinks and other nonalcoholic beverages manufacturing</i>					<i>Lard and other edible animal fats manufacturing</i>			
		Bottled soft drinks	1.0155	0.822 **			Lard and other animal carcasses	0.0054	1.183 ***
	<i>Water purifying and bottling</i>						Pork rind and chitterlings	0.0352	2.643 ***
		Bottled water and packaged ice	0.0861	0.608 ***		<i>Livestock, poultry and other edible animals meat cutting and</i>			
	<i>Brew manufacturing</i>						Beef	0.5887	0.109
		Beer	0.4942	0.121			Pork	0.5387	0.244 *
	<i>Manufacturing of alcoholic beverages from grapes</i>						Poultry	0.3383	0.109
		Brandy	0.0334	0.180		<i>Livestock, poultry and other edible animals meat sausages and</i>			
		Table wine	0.0195	0.228 *			Bacon	0.0977	0.380 *
	<i>Manufacturing of rum and other distilled beverages from cane</i>						Ham	0.1217	0.399 **
		Rum	0.0564	0.222 **			Meat cake	0.0520	0.387 *
	<i>Manufacturing of distilled beverages from agave</i>						Other lunchmeats	0.3240	0.405 **
		Tequila	0.0880	0.104 *			Sausage	0.1493	0.406 **
	<i>Cigarette manufacturing</i>						Smoked, dried and spiced meat	0.3629	0.384 **
		Cigarette	0.1050	-1.363 ***			Spicy pork sausage	0.0422	0.401 **
<b>3 Dairy products manufacturing</b>					<b>7 Other food manufacturing</b>				
	<i>Fluid milk manufacturing</i>					<i>Seasoning and dressing manufacturing</i>			
		Pasteurized milk	0.5726	0.211			Mayonnaise	0.0301	-0.061
	<i>Dairy products and lactic ferments manufacturing</i>						Other dressings	0.0104	-0.040
		American cheese	0.0076	-0.265			Other seasonings	0.0428	-0.066
		Butter	0.0116	-0.163			Salt	0.0150	0.106
		Chihuahua and manchego cheese	0.0268	-0.200		<i>Coffee processing (cleaning, pulp removal, and drying)</i>			
		Cream milk	0.0525	-0.062			Golden coffee	0.0875	-0.104
		Fresh cheese	0.0654	-0.246		<i>Roasted and milled coffee manufacturing</i>			
		Oaxaca and griddle cheese	0.0405	-0.152			Roasted coffee	0.0290	0.478 **
		Other chesses	0.0200	-0.111		<i>Instant coffee manufacturing</i>			
		Yogurt	0.0764	-0.369			Instant coffee	0.0831	0.552 ***
	<i>Dry, condensed and evaporated milk manufacturing</i>					<i>Manufacturing of flavoring concentrates, powders, syrup and</i>			
		Evaporated and condensed milk	0.4715	0.676 **			Soft drinks concentrates	0.2435	-0.068
		Powdered milk and infant formula	0.3108	0.568 **		<i>Snack food manufacturing</i>			
	<i>Ice cream and popsicle manufacturing</i>						Snacks	0.0300	0.393 *
		Ice cream	0.0321	0.193		<i>Other food manufacturing</i>			
<b>4 Fruits, vegetables, stews and prepared meals preserving</b>							Other food products	0.0390	0.287 *
	<i>Fruits and vegetables dehydration, and other processed fruits and vegetables products</i>				<b>8 Seafood preparation and packaging</b>				
		Dehydrated fruits and pulses, marmalade and other packaged vegetables	0.0564	0.076		<i>Seafood preparation and packaging</i>			
		Other canned fruits	0.0223	0.079			Canned tuna and sardine	0.0571	0.238 **
		Packaged juices and nectars	0.0800	0.068			Other packaged seafood	0.0206	0.236 *
		Packaged soups and stews	0.0063	0.087	<b>9 Sugar, chocolate and confectionery products manufacturing</b>				
		Processed chilies	0.0480	0.073		<i>Cane sugar manufacturing</i>			
		Soup concentrates	0.0391	0.030			Sugar	0.3389	0.521
						<i>Chocolate and chocolate products manufacturing from cacao</i>			
							Chocolate bar	0.2179	0.762 *
							Chocolate powder	0.1545	0.877 *

Source: INEGI, own estimations.

Robust standard errors were used to obtain statistical significance. \*\*\*, \*\*, \* indicate statistical significance at 1, 5, and 10 percent levels.

 Items without Positive Asymmetries
  Items with Positive Asymmetries that could not be studied in the Consumer segment
  Items with Positive Asymmetries

**Table 10. Asymmetric Pass-Through in the Wholesale-Retail Segment**

Group	Items by group	Items with positive asymmetries		Cumulative response						
		Number	Weight in the CPI (%)	0 months	1 month	2 months	3 months	4 months	5 months	6 months
<b>Manufactured non-food products</b>										
<i>Apparel</i>	3	1	0.117	-0.233	-0.114	0.206	0.574 *	0.613 **	0.609 **	0.597 **
<i>Educational and recreative goods and supplies</i>	6	4	0.638	-0.338 *	-0.145	0.162	0.159	0.155	0.275	0.327
<i>Footwear and accesories</i>	2	2	1.016	0.118 *	0.298 ***	0.466 ***	0.702 ***	0.804 ***	0.851 ***	0.833 ***
<i>Furniture and domestic appliances</i>	9	7	0.967	0.133 ***	0.279 ***	0.393 ***	0.391 ***	0.417 ***	0.417 ***	0.421 ***
<i>Housekeeping supplies</i>	12	10	1.985	0.248 ***	0.358 ***	0.500 ***	0.730 ***	0.809 ***	0.844 ***	0.853 ***
<i>Medicalcare commodities</i>	4	2	0.046	0.390	-0.119	-0.148	0.327	0.448	0.484	0.494
<i>Motor vehicle parts and equipment</i>	5	5	3.293	0.400 ***	0.644 ***	0.706 ***	0.707 ***	0.611 ***	0.601 **	0.563 ***
<i>Personal care supplies</i>	11	7	2.726	0.181	0.411	0.741 **	0.747 *	0.780 *	0.785 *	0.771 *
<b>Total non-food products</b>	<b>52</b>	<b>38</b>	<b>10.789</b>	<b>0.139 ***</b>	<b>0.259 ***</b>	<b>0.445 ***</b>	<b>0.566 ***</b>	<b>0.601 ***</b>	<b>0.628 ***</b>	<b>0.629 ***</b>
<b>Processed food products</b>										
<i>Alcoholic beverages and tobacco</i>	4	2	0.216	0.131	0.186 *	0.310 ***	0.269 **	0.241 **	0.220 *	0.201 *
<i>Bakery products, tortilla and cereals</i>	6	5	0.678	0.455 ***	0.490	0.462	0.639	0.846 *	0.935 **	0.859 **
<i>Eggs, diary and related products</i>	9	4	2.186	0.047	0.104	0.092	0.157	0.272 *	0.276	0.350 *
<i>Fresh fruits</i>	13	5	0.682	0.077 *	0.103 *	0.066	0.117	0.132 *	0.155 **	0.146 **
<i>Fresh meats and other animal products</i>	6	3	3.187	0.184 ***	0.241 ***	0.195 **	0.208 **	0.198 **	0.179 **	0.159 *
<i>Fresh vegetables</i>	13	4	0.680	0.075 ***	0.100 ***	0.048	0.024	0.024	0.023	0.026
<i>Other foods</i>	4	3	0.163	0.309 ***	0.907 ***	1.672 ***	1.729 ***	1.681 ***	1.572 ***	1.490 ***
<i>Processed fruits and vegetables</i>	6	6	0.452	0.279 **	0.587 **	0.792 ***	0.766 **	0.870 ***	0.946 ***	0.921 ***
<i>Processed meat and animal products</i>	4	2	0.234	0.187 *	0.260 *	0.291 *	0.245	0.223	0.214	0.210
<i>Sugar, coffee and soft drinks</i>	5	5	1.819	0.346 ***	0.654 ***	1.059 ***	0.968 ***	0.955 ***	0.940 ***	0.919 ***
<b>Total processed food and raw products</b>	<b>70</b>	<b>39</b>	<b>10.296</b>	<b>0.174 ***</b>	<b>0.288 ***</b>	<b>0.363 ***</b>	<b>0.382 ***</b>	<b>0.419 ***</b>	<b>0.427 ***</b>	<b>0.418 ***</b>

Source: Own estimations.

Robust standard errors were used to obtain statistical significance. \*\*\*, \*\*, \* indicate statistical significance at 1, 5, and 10 percent levels.

**Table 11. Speed of Price Transmission in the Wholesale-Retail Segment**

Industry category	Positive pass-through						Negative pass-through							
	0 months	1 month	2 months	3 months	4 months	5 months	6 months	0 months	1 month	2 months	3 months	4 months	5 months	6 months
<b>Manufactured non-food products, three-digit NAICS, subsector</b>														
<i>Apparel</i>	0.18	0.46	0.65	0.84	0.92	0.97	1.00	-1.39	-3.31	-0.47	1.07	1.36	1.23	1.00
<i>Educational and recreative goods and supplies</i>	0.23	0.57	0.71	0.88	0.94	0.98	1.00	0.95	1.18	0.97	0.96	0.99	0.99	1.00
<i>Footwear and accesories</i>	0.13	0.30	0.43	0.68	0.87	0.99	1.00	0.04	0.84	1.34	2.15	1.91	1.48	1.00
<i>Furniture and domestic appliances</i>	0.21	0.44	0.65	0.79	0.88	0.94	1.00	0.21	0.23	0.30	0.64	0.75	0.76	1.00
<i>Housekeeping supplies</i>	0.21	0.46	0.70	0.86	0.94	0.98	1.00	0.37	0.79	0.87	1.01	0.99	1.04	1.00
<i>Medicalcare commodities</i>	0.24	0.46	0.69	0.85	0.93	0.98	1.00	-0.42	-0.40	0.98	1.11	1.07	0.96	1.00
<i>Motor vehicle parts and equipment</i>	0.39	0.59	0.79	0.94	0.99	0.99	1.00	0.57	0.40	1.31	1.46	1.17	1.07	1.00
<i>Personal care supplies</i>	0.24	0.47	0.60	0.81	0.90	0.96	1.00	0.43	0.46	0.68	0.89	0.99	1.00	1.00
<b>Total non-food products</b>	<b>0.22</b>	<b>0.46</b>	<b>0.65</b>	<b>0.82</b>	<b>0.92</b>	<b>0.97</b>	<b>1.00</b>	<b>0.25</b>	<b>0.43</b>	<b>0.65</b>	<b>0.94</b>	<b>0.98</b>	<b>1.00</b>	<b>1.00</b>
<b>Processed and raw food products, four-digit NAICS, industry group</b>														
<i>Alcoholic beverages and tobacco</i>	0.34	0.61	0.79	0.87	0.94	0.97	1.00	0.35	0.38	0.40	0.63	0.79	0.90	1.00
<i>Bakeary products, tortilla and cereals</i>	0.39	0.70	0.83	0.89	0.95	0.98	1.00	0.10	0.41	-0.10	0.25	0.20	0.94	1.00
<i>Eggs, diary and related products</i>	0.18	0.51	0.72	0.82	0.96	0.97	1.00	0.20	0.58	0.73	0.85	0.93	1.04	1.00
<i>Fresh fruits</i>	0.69	0.85	0.90	0.90	0.90	0.96	1.00	0.63	0.83	0.92	0.96	0.88	0.94	1.00
<i>Fresh meat and other animal products</i>	0.40	0.66	0.75	0.87	0.93	0.97	1.00	0.24	0.35	0.62	0.81	0.91	0.97	1.00
<i>Fresh vegetables</i>	0.76	0.88	0.90	0.89	0.93	0.96	1.00	0.61	0.82	0.86	0.91	0.94	0.97	1.00
<i>Other foods</i>	0.20	0.48	0.71	0.85	0.92	0.95	1.00	0.39	0.51	0.94	0.99	1.09	1.11	1.00
<i>Processed fruits and vegetables</i>	0.28	0.59	0.75	0.85	0.91	0.96	1.00	0.32	0.39	0.55	0.61	0.78	0.95	1.00
<i>Processed meat and animal products</i>	0.46	0.65	0.68	0.88	0.94	0.97	1.00	0.25	0.16	1.12	1.11	1.08	1.04	1.00
<i>Sugar, coffee and soft drinks</i>	0.40	0.75	0.86	0.92	0.97	0.99	1.00	-0.25	0.47	0.92	1.15	1.13	1.06	1.00
<b>Total processed food and raw products</b>	<b>0.41</b>	<b>0.70</b>	<b>0.78</b>	<b>0.88</b>	<b>0.93</b>	<b>0.97</b>	<b>1.00</b>	<b>0.34</b>	<b>0.58</b>	<b>0.80</b>	<b>0.84</b>	<b>0.90</b>	<b>0.97</b>	<b>1.00</b>


Source: Own estimations.

**Table 12. Asymmetric Pass-Through by Item in the Wholesale-Retail Segment**

Group	Item	Wight in the CPI (%)	Asymmetry in price transmission	Group	Item	Wight in the CPI (%)	Asymmetry in price transmission
<b>Fresh fruits</b>				<b>Processed fruits and vegetables</b>			
	Apple	0.2273	0.419 *		Packaged juices and nectars	0.2028	1.126 *
	Lemon	0.2073	0.318 *		Packaged chilies, moles and other sauces	0.1009	0.775
	Banana	0.1702	-0.263 **		Other dry pulses	0.0560	0.302 **
	Other fruits	0.1327	0.432		Packaged beans	0.0543	0.139 *
	Avocado	0.1134	-0.135		Other canned fruits	0.0222	0.464 **
	Papaya	0.0781	0.098		Instant soups and tomato sauce	0.0153	1.798 ***
	Grapes	0.0735	1.366 ***	<b>Eggs, dairy and related products</b>			
	Peach	0.0560	-0.070		Pasteurized and fresh milk	1.4288	0.556 *
	Melon	0.0462	-0.363 **		Egg	0.6138	0.142 *
	Guava	0.0410	0.157		Fresh cheese	0.2222	0.179
	Orange	0.0352	0.126		Yogurt	0.2185	-0.010
	Watermelon	0.0254	-0.337 **		Milk cream	0.1204	0.119
	Pineapple	0.0139	-0.078		Powdered milk	0.1071	-0.345
<b>Fresh vegetables</b>					Ice cream	0.0359	0.593
	Tomato	0.4945	-0.007		Butter	0.0267	0.048
	Beans	0.2802	0.483 **		American cheese	0.0233	0.501 **
	Potatoes and other tubers	0.2470	0.104	<b>Other foods</b>			
	Other pulses	0.2042	-0.047		Oil and edible fats	0.2448	-0.114
	Onion	0.1697	0.211 **		Soft drink concentrates	0.0914	0.267
	Husk tomato	0.1305	-0.129		Chocolate	0.0489	1.179 ***
	Zucchini	0.1265	0.147 **		Other seasonings	0.0226	5.586 ***
	Lettuce and cabbage	0.1047	-0.194	<b>Bakery products, tortilla and cereals</b>			
	Other fresh chilies	0.0913	0.224 *		Cornflakes	0.2062	0.687 *
	Carrots	0.0692	0.256 ***		Cookies	0.1657	0.426
	Nopal	0.0666	0.115 *		Rice	0.1492	0.518 ***
	Cucumber	0.0400	-0.066		Noodles and other soups	0.1239	1.606
	Dry chili	0.0266	0.147		Corn dough and flour	0.0502	-0.226
<b>Fresh meat and other animal products</b>					Wheat flour	0.0327	0.666 ***
	Beef	1.7762	0.640 *	<b>Sugar, coffee and soft drinks</b>			
	Poultry	1.3230	0.272 ***		Bottled soft drinks	1.0909	2.532 *
	Pork	0.6935	0.206 *		Bottled water	0.3997	0.332 **
	Fish	0.3226	0.093		Sugar	0.1804	0.349 ***
	Shrimp	0.0876	0.347 ***		Instant coffee	0.1173	1.196 ***
	Other seafood	0.0176	-0.115		Roasted coffee	0.0304	0.432 ***
<b>Processed meat and animal products</b>							
	Ham	0.1965	0.570				
	Canned tuna and sardine	0.1331	-0.162				
	Sausages	0.1201	0.383 **				
	Canned seafood	0.0371	0.590 **				

Source: INEGI, own estimations.

We used robust standard errors to obtain statistical significance. \*\*\*, \*\*, \* indicate statistical significance at 1, 5, and 10 percent levels.

 Price series with positive price asymmetries